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RAILWAY
MECHANICAL ENGINEER

New Developments in

Design of Locomotive Boilers*

THE term "forced-circulation" is used to describe the system in which a circulating pump takes water from a boiler drum and delivers it to the steam-generating tubes at a pressure substantially higher than boiler pressure. The weight of water circulated is many times greater than the maximum steam output and the water is distributed to the various tubes by metering orifices.

In any boiler it is necessary to supply water to the steam-generating surface in sufficient quantity to absorb the heat as fast as the furnace or gases deliver it to the heat-transfer surface. In a simple natural circulation boiler the steam is generated in tubes which obtain water from a lower drum and discharge into an upper or steam drum. Water is returned from the steam drum to the lower drum by a downcomer which is located in a relatively cool zone. When heat is applied to the steam-generating tubes the density of the steam and water mixture in the tubes becomes less than that of the water in the downcomer and circulation takes place in proportion to the amount of heat applied. This basic principle is true of all natural-circulation boilers although generally the actual circulation is much more complicated than described. In a locomotive firebox, for example, water is rising close to the firebox sheet

* One of three papers on new boiler design presented September 16, 1947, at the annual meeting of the Master Boiler Makers' Association at Chicago.
† Vice-president, The Superheater Company.

By Arthur Williams†

Operating at 600 lb. per sq. in. and 900 deg. F., proposed design has water-tube firebox and fire-tube barrel with pumps producing positive water circulation

and descending at the wrapper sheet at the same time. Obviously, the circulation in a natural-circulation boiler will depend on the permissible vertical distance between the upper and lower drums. When this is restricted it is difficult to obtain good circulation with high rates of heat transfer.

In the forced-circulation system a circulating pump takes water from the top drum and discharges it at a pressure higher than boiler pressure to a header. From this header the water flows to the steam-generating tubes. At the entrance to each tube is a metering orifice and the circulating pump supplies sufficient head to force the water through the metering orifice and overcome

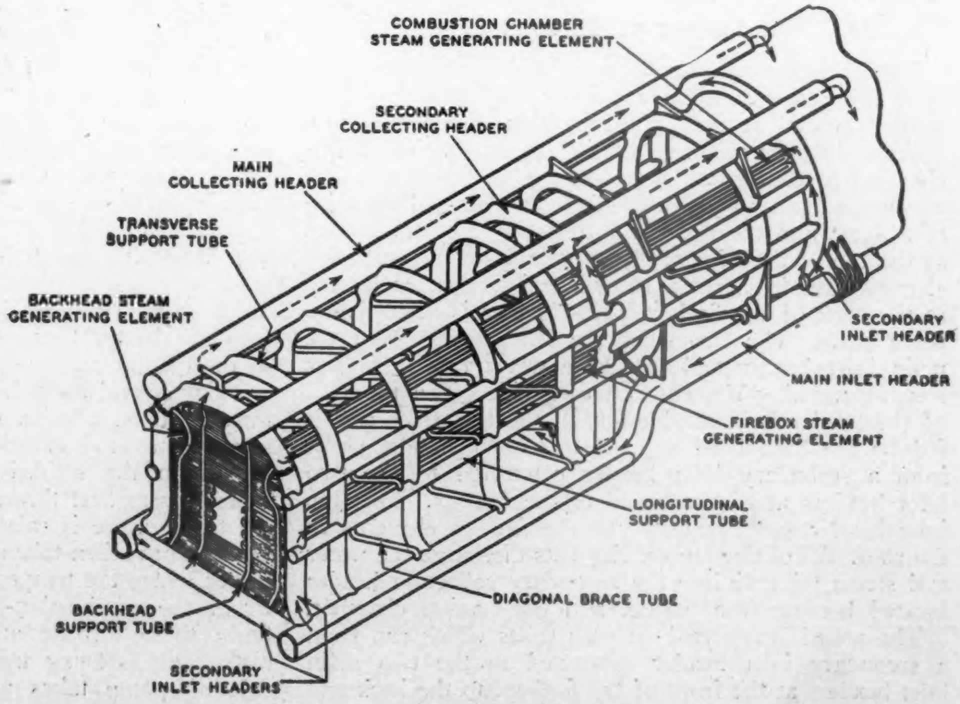

Fig. 1—Forced circulation locomotive firebox

the resistance to flow in the tube. With this arrangement, the steam-generating tubes can be located in any manner desired without regard to the vertical clearance permissible. Since each tube is being fed a definite pre-determined quantity of water, the tube can be run with the flow upward, horizontal or even downward.

Fig. 1 shows a forced-circulation firebox applied to a fire-tube barrel. Inlet and collecting headers together with support tubes are welded together to produce a structure equal in strength to the conventional boiler with stayed firebox. The steam-generating elements consist of relatively small diameter tubing arranged around the inside of the supporting structure and connected to the headers. Water from the circulating pump is fed to two main inlet headers located at the bottom corners of the structure. The water from these main inlet headers is led through secondary inlet headers to the steam-generating surface. The steam-generating elements discharge into secondary collecting headers which, in turn, feed the main collecting header. From these, the steam and water mixture flows into the fire-tube barrel. The quantity of water circulated will depend on the design and operating conditions. When generating steam at maximum capacity, the ratio of water circulated to steam generated will be approximately ten to one, but may be higher or lower than this figure.

Design of Firebox

The firebox structure will first be described, and then later the entire locomotive boiler. The secondary inlet header located at the back tube sheet feeds the combustion-chamber steam-generating elements. These discharge into the secondary collecting header located between the firebox and combustion chamber and the mixture flows into the two main collecting headers located at the top of the firebox. The firebox steam-generating elements are fed from a secondary inlet header located at the back of the firebox. This header is divided into three parts. The two sides are fed directly from the main inlet header and discharge water to the firebox steam-generating elements on each side. The top part of the header is blanked off from the two sides and is fed by the back head support tubes which take water from a secondary inlet header connected to the two inlet headers at the back end of the firebox. This top inlet header supplies water to the firebox elements in the roof. All of the firebox elements discharge the water and steam mixture into the secondary collecting header located between the firebox and combustion chamber.

The arch is supported on arch tubes which run from a secondary inlet header connected to the two main inlet headers at the front of the firebox, to the back end of the firebox, where they discharge into the collecting headers. Outside of the heating surface are a number of longitudinal and transverse support tubes. To give greater strength and rigidity, the longitudinal support tubes are also connected with diagonal brace tubes. The support tubes are furnished with a small amount of water from the inlet headers and discharge to the collecting headers. No appreciable steam is generated in these tubes and the only purpose of furnishing the water at saturation temperature from the circulating pump is to insure that all of the elements making up the entire structure, that is, headers, support tubes and steam generating elements, are at substantially the same temperature. This makes it possible to weld together all of the headers and support tubes and thus obtain a structure equal in strength to the conventional locomotive boiler. Furthermore, the steam-generating elements can be fastened in place without any possibility of troubles from vibration by welding where necessary to the support tubes.

The Complete Boiler

A complete design of locomotive boiler suitable for 600 lb. per sq. in. and 900 deg. F. is shown in Fig. 2. The firebox is the same as shown in Fig. 1. The front part of the boiler is of the conventional fire tube construction. The two inlet headers, the two collecting headers and the secondary header at the front end of the firebox are joined to the barrel with proper welding and bracing to give secure attachment. The two collecting headers each discharge to a centrifugal type steam separator. The centrifugal separator will discharge all of the water beneath the water line in the barrel and only dry steam will flow into the steam space in the barrel. A high efficiency of separation is possible since the circulating pump furnishes sufficient head to overcome the pressure drop through the steam separator. With only dry steam being delivered from the firebox into the barrel there should be a great improvement in the quality of steam entering the dry pipe.

Primary and secondary superheaters are used to produce a steam temperature of 900 deg. F. All of the steam generated enters the dry pipe and flows to a header in the smokebox in the usual manner. The steam passes first through a firetube superheater where the temperature is raised to approximately 750 deg. F. The steam is then taken to a combustion-chamber superheater where the temperature is increased to 900 deg. F. From the combustion-chamber superheater the steam flows to a throttle and thence to whatever driving mechanism is being used on the locomotive. The circulating pump takes water from the barrel and dis-

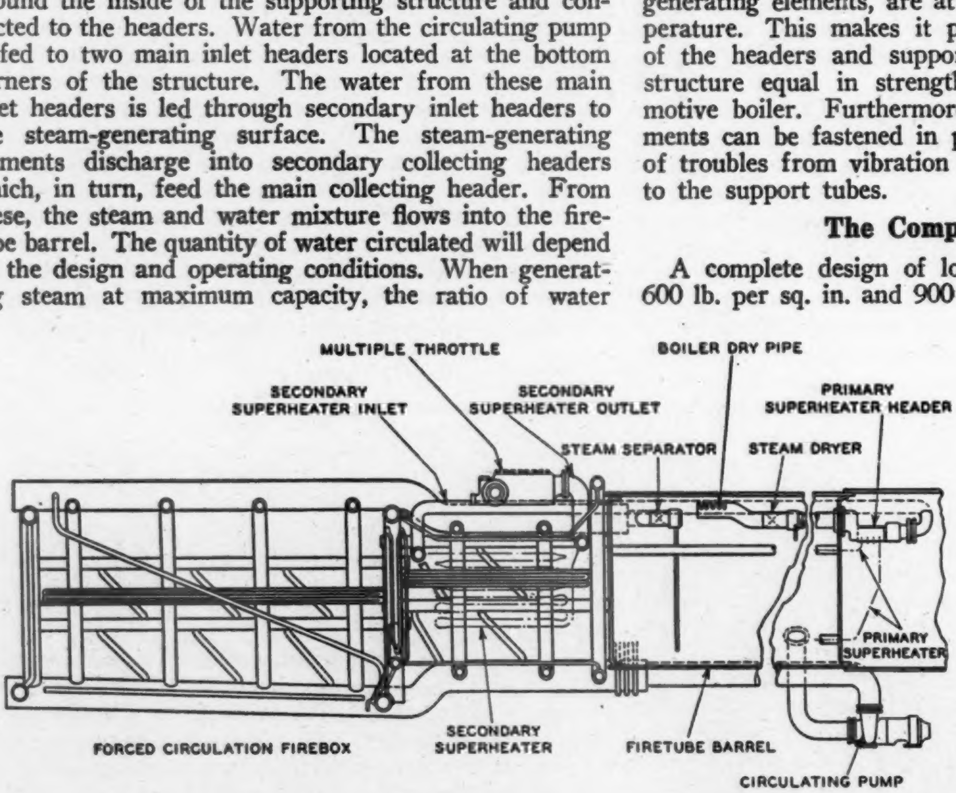

Fig. 2 — Forced-circulation locomotive boiler

charges it to the firebox inlet headers. All of the feedwater is introduced into the barrel so that scale-forming matter is thrown out of solution before it is taken to the firebox heating surface.

Advantages of Design

In a natural-circulation boiler relatively large tubing has to be used so that the resistance to flow will be kept at a minimum. With the circulating pump to overcome flow resistance small tubing can be used. For the same operating pressure the smaller diameter permits less wall thickness with a reduction in weight and with lower stresses due to the temperature differential between the inner and outer wall surfaces.

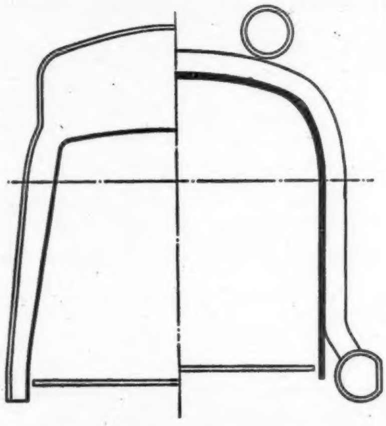

Fig. 3—Comparison of conventional and forced-circulation fireboxes

If the water is circulated through steam-generating tubes at a sufficient velocity, scale deposits can be eliminated or at least kept to a minimum. In a natural-circulation boiler, whether of the staybolt or tubular types, some parts of the boiler will receive more water than is necessary to keep scale deposits at a minimum and other parts will receive less. With the forced-circulation system, every tube is furnished with water at a velocity sufficient to minimize scaling, and the metering orifice at the tube entrance ensures that this quantity will be at the desired figure regardless of the rate of operation.

The circulating pump can continue to run while the boiler is cooling down and in this way the firebox heating surface will be washed with hot water every time this is done. During the cooling-down period the pump will circulate large quantities of water from the barrel to the firebox and back to the barrel. In this way, the entire boiler structure will be cooled uniformly and should permit much less time for cooling down than is now necessary. During operation, the positive circulation of water through the firebox elements will insure that there is no sludge accumulation at any point in the firebox. This will mean that blowing of the boiler from the locomotive barrel will insure positive control of boiler-water concentration with respect to both dissolved and suspended solids.

Maintenance of the steam-generating surface is easy since an element consisting of several pipes can be re-

(Continued on page 77)

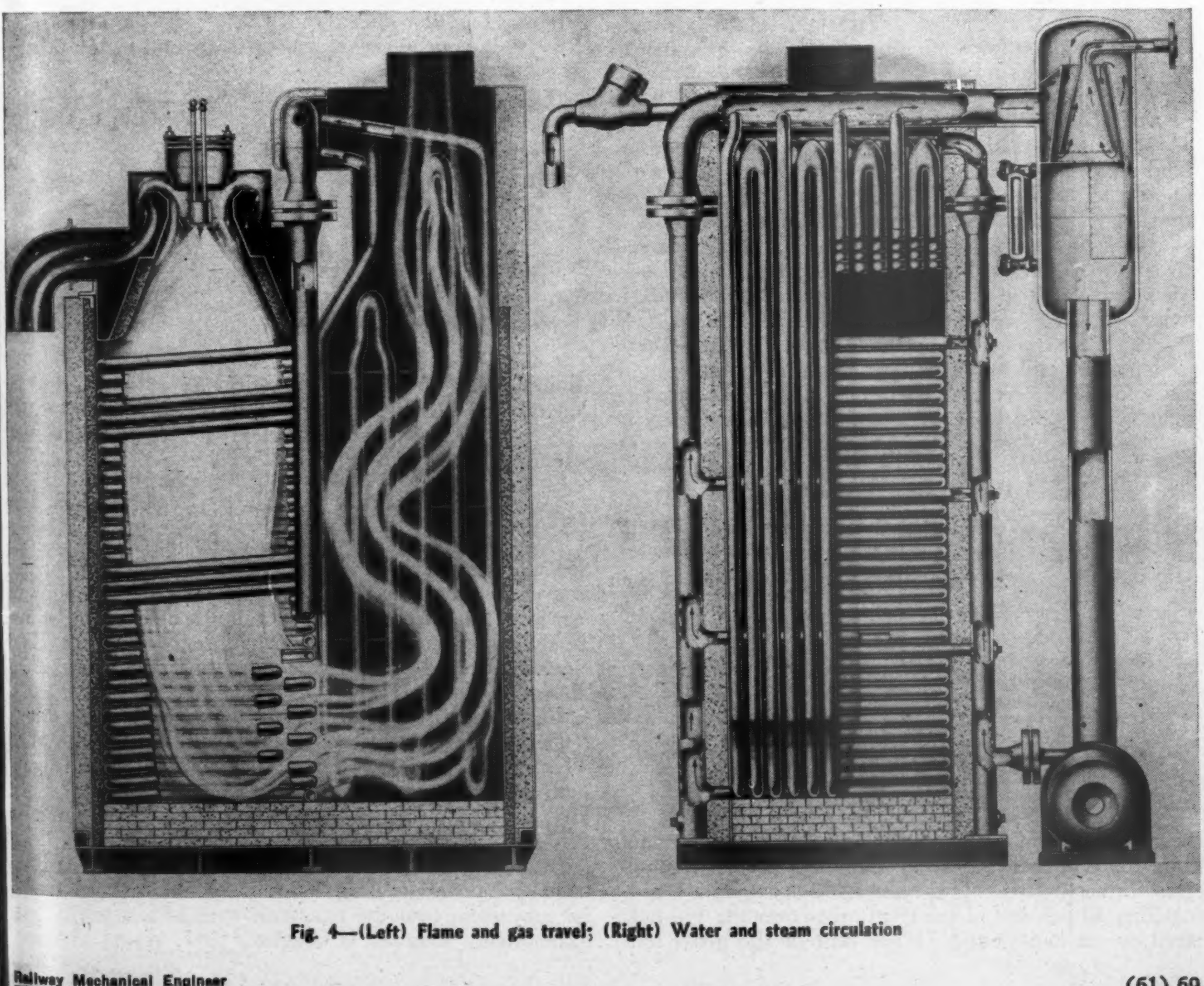

Fig. 4—(Left) Flame and gas travel; (Right) Water and steam circulation

Symposium on

Diesel Performance

New York Railroad Club meeting brings out interesting data on the problems involved in operation and maintenance of Diesel power on six roads

The maintenance problems and the performance of Diesel-electric locomotives as compared with steam was discussed at a meeting of the New York Railroad Club on November 20, 1947, at which six speakers, representing as many different roads, contributed information concerning the operation of that type of power on their respective roads and included in their presentation statistics indicative of operating cost and performance. These speakers were F. T. James, chief of motive power, Delaware, Lackawanna & Western; G. H. Higley, general air brake inspector, Erie; L. P. Zeigler, superintendent, Lehigh Valley; F. Thomas, assistant to general superintendent motive power, New York Central System; I. R. Pease, superintendent of motive power, New York, Ontario & Western; and L. Richardson, assistant general manager, New York, Susquehanna & Western.

Freight Operation on the D. L. & W.

The present ownership on Freight Diesel locomotives on the Lackawanna is 12, six of which are three units each and the remaining six two units. The three-unit locomotives, geared for top speeds of 65 m. p. h., are used in road freight service and the two-unit locomotives, geared for 50 m. p. h., are used in helper service on mountain grades. The road freight locomotives average about 11,500 miles a month and the two-unit helpers about 5,700 miles a month. The three-unit road freight Diesels are used in combination with modern 4-8-4 types steam locomotives and, over the period in which the Diesels have been in service, gross ton-miles per train-hour have shown an increase of 18 per cent. The use of Diesels as helpers has resulted in a decrease of 29 per cent in freight helper locomotive-miles on the basis of equal gross ton-miles handled. The 12 Diesel locomotives have permitted the retirement of 41 steam locomotives and, at one location, six steam locomotives in helper service were replaced by a single Diesel.

The Lackawanna operation indicates that Diesel freight locomotives can produce one thousand gross ton-miles for 73 per cent less operating and maintenance cost than steam locomotives and that in that case the increase in locomotive miles per day was 133 per cent.

Diesel Performance on the Erie

For a period of 34 months the Erie has had 5,400 hp. Diesel-electric freight locomotives in service between Marion, Ohio, and Meadville, Pa., and has found that the newer type of motive power can handle 80 per cent more tonnage than the heavy 2-8-4 type steam locomotives formerly used. These six 5,400-hp. units are now handling 50 per cent of the train miles over the 114-mile territory mentioned and 71 per cent of the gross ton-miles. The six Diesel-electric locomotives have made possible the transfer of 18 steam locomotives to other territories and as a result the retirement of a greater number of lighter steam units of obsolete design has been effected.

Table I—Locomotive Performance

Hours operated	118,629
Hours out of service, Insp. & Rprs	21,633
Hours available, not used	8,939
Total potential hours	149,201
Per cent utilization	79.5
Per cent availability	85.3
Total mileage 34 months	2,276,767

The performance of the six Erie 5,400 hp. Diesel locomotives for the 34-month period of ownership, including August, 1947, is shown in Table I.

The mileage for each individual locomotive was from 410,000 to 415,000 miles.

For the 34-month period of operation the six Diesels have averaged 7.4 gallons of fuel oil per mile and the cost per thousand gross ton miles $.194; this cost includes, fuel oil, lubricating oil, other supplies, labor, material, enginehouse expense—labor and material, fueling expense.

In August, 1947, 673 Diesel freight trains were operated and, to handle the same tonnage as was handled in 673 Diesel trains with steam power, would have required 1,144 steam trains or a saving of 471 trains by operating with Diesel versus steam.

Table II—Train Performance

Train miles — Diesel	808,337
Equivalent — steam	1,341,371
Saving train miles — Diesel vs. steam	533,034
Diesel locomotive miles	825,476
Equivalent with steam	1,445,330
Saving locomotive miles — Diesel vs. steam	620,854

Table II shows the year 1946, Diesel versus steam, on a mileage basis.

Helper Service on the Lehigh Valley

The Lehigh Valley uses two 5,400 hp. Diesel-electric locomotives which were purchased exclusively for helper service between Coxton, Pa., and Gracedale, a mountain grade 21 miles long having a ruling grade at one point of 1.16 per cent with many eight-degree curves. The performance of these locomotives in helper service is shown in Table III.

For comparison of trains and tons moved with steam helper locomotive, December, 1944, the last month that all freight helper service was performed by steam locomotives, is compared with August, 1947, when practically all freight helper service was performed by two 5,400 hp. Diesel locomotives.

In December, 1944, it was necessary to reduce the tonnage of the average train 266 tons, or five cars per train, for movement over the mountain with 2.03 steam helper locomotives, whereas in August, 1947, trains arriving

at Coxton from the west have an average of 915 tons added, or 11 cars, with one Diesel locomotive helper.

In December, 1944, there was an average of 24 helper locomotives and crews boarded per day. To furnish this service it was necessary to have in service 15 steam helper locomotives. In August, 1947, there was an average reduction in number of trains over the mountain per day of 4.65. On this basis with the business now handled, and if steam helpers were used, it would require ten steam helper locomotives, as against two 5,400 hp. Diesel locomotives now in service.

Table III—Comparative Operating Data

December, 1944	
Average through freight trains per day Sayre, Pa. to Coxton	9.5
Average cars per train	83.0
Average tons per train	4551
Average freight trains per day Coxton east	12.16
Average cars per train	78
Average tons per train	4285
Average steam helper Locomotives per train	2.03
Average time Coxton to Gracedale	1 hr. 35 min.
Average miles per hour Coxton to Gracedale	13
August, 1947	
Average through freight trains per day Sayre, Pa. to Coxton	8.6
Average cars per train	76
Average tons per train	3872
Average freight trains per day Coxton east	7.51
Average cars per train	87
Average tons per train	4787
Average Diesel helper locomotive per train	1
Average time Coxton to Gracedale	1 hr. 23 min.
Average miles per hour Coxton to Gracedale	15

Cost of Helper Operation

In December, 1944, there was a movement of 1,615,362 tons over the mountain between Coxton and Gracedale at a cost of 3.67 cents per ton. In August, 1947, there was a movement of 1,115,500 tons at a cost of 1.21 cents. This cost per ton moved includes wages of helper engine crews, fuel, enginehouse expense, supplies and maintenance of locomotives, a saving of 2.46 cents per ton or $27,441.30. If operating today with steam helper locomotives, with the increased cost of fuel and increase in wages granted in May, 1946, it would cost 4.35 cents per ton; therefore, by present Diesel helper operation a saving of $35,026.70 in August 1947 was realized.

With the use of the Diesel helper locomotives many hidden savings have been made. For example—by the added tonnage of trains leaving Coxton the equivalent of 27 trains for the month of August 1947 have been absorbed. This represents a saving of $5,527.44 for this period. The road has been relieved of the expense of maintaining ten steam locomotives; the servicing time of steam helpers average 2¼ hours per locomotive, whereas the servicing time of the Diesel is 30 minutes. With the Diesel the turning of the locomotive prior to leaving Coxton and prior to returning from Gracedale to Coxton has been eliminated. This also permitted the abolishment of three switch tenders. With the use of steam helpers when three were required, two were coupled to the caboose and one to the lead engine, and because of this it was necessary to stop at Gracedale to uncouple from the train, after which it was necessary to make a brake test, and set retainers before proceeding east. With the present operation, after the brake test is made, the retainers are set which reduces the road time. All water stops on the mountain have been eliminated whereas, in December, 1944, there were 71 trains that made water stops.

The elimination of water stop contributed materially to a reduction in road and terminal delays and drawhead failures.

Passenger Handling on the New York Central

Mr. Thomas, in outlining some of the problems with which the New York Central was faced, told of the changes that were required in the handling of fuel and water for Diesel passenger power in order to make the most efficient use of this type of power. One of the unusual developments along this line was the building of portable fuel and water cars that could be spotted at different locations over the territory in which the new Diesel power was operated until such time as it could be determined where permanent facilities should be established. These portable supply cars were designed in such manner that they could pump at least 300 gallons of fuel oil and 500 gallons of water per minute. A 4,000 hp. passenger locomotive equipped with two steam generators requires approximately three gallons of fuel per locomotive mile and 750 gallons of water per hour to handle 14- to 16-car trains in severe winter weather. As a protection against delays due to running out of heating boiler water there was built into the passenger Diesel a steam-operated siphon which could take approximately 100 gallons of water a minute out of a source such as a steam locomotive tender, track pan or roadside pond.

Mr. Thomas, in speaking of the scheduling of runs, brought out that proper scheduling has made possible maximum mileage of Diesel power and that on the New York Central, over a 30-month period, the passenger locomotives have averaged slightly under 30,000 miles a month and that one single locomotive, in 31 months, had covered 900,274 miles. It was of incidental interest that at the end of that mileage this locomotive was placed over the drop pit and the first truck removed that had been removed from the Diesel passenger locomotive after that accumulation of mileage. The truck change required one hour and ten minutes.

The development of the Diesel supervisory staff on the N. Y. C. and the part played in training men through the use of instruction cars was dealt with by Mr. Thomas.

Conversion Problems on the O. & W.

Early in 1945 the O. & W. took delivery of nine 2,700 hp. Diesel-electric freight locomotive units which permitted the movement of approximately 80 per cent of the main line freight tonnage in Diesel operated tranis. During 1948 the road expects to install 46 additional units for freight, passenger and switching service. The experience of the O. & W. has indicated the replacement of steam by Diesel has been in the ratio of approximately two to one. In 18 months of operation each of the nine 2,700 hp. locomotives has made approximately 216,000 miles and to date no operating failures have been experienced; no traction motor or main generator has been burned up (this being attributed to a 65:12 gear ratio which acts as a safety valve in overload conditions); only two shop man-failures have occurred and no locomotive has been held out of service more than 48 hours for inspection or repair except in the case of two collisions and two derailments.

Diesels on the Susquehanna

In outlining the service obtained from 20 combination Diesel-electric locomotives on the Susquehanna, Mr. Richardson presented a chart showing a 24-hour service record of each of these locomotives in the different classes of service. An analysis of the service indicated that the overall utilization of the Diesel-electric locomotives on the Susquehanna is 84 per cent. Only 6.9 per cent is spent awaiting service and 9.1 per cent of the time is spent in the shop.

Hopper-Car Evolution*

By George A. Suckfield†

Examples of three periods of steel-car development and of lightweight construction presented and discussed — Author suggests increased cost of better brakes should not be charged to weight reduction

After examination of drawings of many hopper cars, from those of the very first lot of steel hopper cars built in 1897 to those last built, nine designs have been selected to highlight development. Weight, capacity and bare body weight per cubic foot of coal carrying capacity for each of these are shown in the table.

Cars numbered 1, 2 and 3 were selected to illustrate progress and represent three important periods in car development. The first period extended from 1897 to about 1918; the second, from 1918 to 1935, and the third from 1935 to the present time. Cars numbered 1, 2 and 3 were built of carbon steel. Cars 4 to 8, inclusive, utilized materials other than carbon steel for all or parts of their body structure. Car No. 9 is included only for comparison with No. 8. Except for No. 5, which represents a welded design, bodies for all of these cars are riveted structures.

Three Development Periods

Car No. 1 is a Pennsylvania Class GLA hopper car. This is selected to represent the first period in the development because its weight and capacity check closely with the average for a large number of cars built for many railroads between 1897 and 1918. In this first period the steel car and the steel hopper car were new and a wide variety of construction details were developed and built into the cars. Some features in the very first design still remain among the most favored. One of these is the saw-tooth arrangement of hoppers and another, the 30-deg. slope for end floor. Couplers, draft gear and reinforcing members for top of sides on the first cars were soon proved deficient and were strengthened. By the end of this period most railroads were specifying continuous center sills formed of rolled sections, bulb angles for reinforcing the top of sides, 5-in. by 7-in. shank couplers, friction draft gear and arch-bar trucks.

Car No. 2 is the United States Railway Administration 55-ton hopper. This was developed by engineers representing the larger car-building companies and was approved by engineers representing the railroads. Complete sets of detail drawings for this and other U.S.R.A. cars were furnished nearly all railroads and many cars of this design were built between 1918 and 1935. This design provided construction details proved in the first period and capacity for hauling 55 tons of coal.

Prior to 1928, most general-purpose hopper cars utilized flat side sheets with reinforcing members on the outside of the car, but about 1928 many roads changed their sides by sloping the side sheets in near the top, and placing stiffening stakes on the inside. This arrangement offers flat surfaces throughout most of the car length for engaging supporting members in car dumpers and affords the desired capacity in the shortest length.

In the second period, 6-in. by 8-in. shank couplers with cast-steel yokes and key attachments and cast-steel side-frame trucks came into general use. Also, hooks and latches for locking hopper doors advanced in favor over devices operated by shafts and locked by means of ratchets and pawls.

Creation of this design and the wide distribution of its detail drawings brought to attention the economies and advantages offered by a standard car and paved the way for the adoption of the AAR standard hopper cars in 1935.

Car No. 3, representing the third period, is an AAR standard 50-ton hopper car except that it is equipped with I-beam bolsters and with weldments substituted for body castings. The AAR standard hopper car was designed in 1934 by the American Railway Car Institute Committee on Freight Car Design working in conjunction with the Car Construction Committee of the Mechanical Division, Association of American Railroads. This design met with considerable favor and many of these cars have been built since 1934. It refined and simplified construction details proved in the first and second periods and offered several new features. One of these is the welded Z-section center sill and, another, the one-piece hopper chute with welded door frame. It also took advantage of changes in road clearances and loading rules to provide sufficient capacity to receive a

* From a paper presented at a Railroad Division session during the annual meeting of the American Society of Mechanical Engineers held at Atlantic City, N. J., December 1-5, 1947.

† Consulting engineer, Pressed Steel Car Company.

The Trend of Hopper-Car Design from the Beginning of the Steel Era

No.	Nominal Capacity, tons	Body Material	Weight of Complete Car, lb.	Weight of Trucks, lb.	Weight of Couplers; Draft Gear, and Air-Brake Equipment, lb.	Weight of Body Excl. of Coupler, Draft Gear, and Air-Brake Equipment, lb.	Capacity with 10-in. Average Heap, cu. ft.	Body Weight, Excl. of Couplers, Draft Gear, and Air-Brake Equipment per cu. ft. of Heaped Capacity, lb.
1	50	Carbon steel	39400	16400	2140	20860	1923	10.84
2	50	Carbon steel	41300	16400	2640	22260	2120	10.50
3	50	Carbon steel	41200	16180	2951	22069	2429	9.08
4	50	Cor-Ten steel	30800	12200	2700	15900	2605	6.10
5	50	Cor-Ten steel	33500	14000	3294	16206	2553	6.35
6	50	Aluminum and carbon steel	31600	14000	2781	14819	2630	5.63
7	50	Wood and carbon steel	43200	15700	2780	24720	2307	10.71
8	70-90	Cor-Ten steel and carbon steel	48600	22700	3150	22750	3086	7.37
9	70-90	Carbon steel	59300	24800	2810	31690	2975	10.65

load of coal equal to the rail load-limit weight minus empty-car weight. The sides are of the inbent type, reinforced at top by 5-in. bulb angles and with stakes on the inside. By the time this car was developed couplers and attachments, dimensions for draft gear and essential dimensions for trucks had been standardized and AB brake equipment was required on all new cars.

Experience with Light Weight

Car No. 4 was designed by the Pressed Steel Car Company in 1934 to take full advantage of the physical properties of the then new Cor-Ten steel and high-tensile steel castings to provide a car of minimum weight which would carry the maximum allowable load of coal and other bulk materials.[1] Compared with cars built of carbon steel, the sheets and plates used in this design are very thin and when this was first offered many railroad men thought that it would not stand up in service. Early in 1935, 110 of these cars were placed in service on three railroads. One of these cars, taken from service on the Bessemer & Lake Erie, was exhibited at Atlantic City in June of last year while the convention of the Mechanical Division, Association of American Railroads was in progress. After more than twelve years' service a few small holes and cracks have developed in floor and side sheets, but officers responsible for their repair estimate that with a little patching they will attain at least two more years' service from these sheets before they require replacement. One-quarter-inch copper-bearing-steel floor sheets in hopper cars on this particular line are regularly replaced in from 12 to 14 years. Cars in service on the Pittsburgh & Lake Erie required patching after 11 years. On this road, ¼-in. copper-bearing-steel floors are usually replaced in from 10 to 12 years. Cars in operation on the Burlington had sides and floor sheets replaced in December, 1926, after nearly 12 years' service. Repairmen on this railroad decided to replace these sheets rather than patch cracks and small holes that had developed in them.

Twelve years' experience with these ultra-light-weight cars on three railroads shows that they are providing service life comparable with that of ¼-in. copper-bearing-steel floors in hopper cars and suggests that slightly heavier Cor-Ten steel sheets equally well supported will outlast ¼-in copper-bearing-steel. The service life of ¼-in. copper-bearing-steel floors in hopper cars varies widely in different sections of the country and on different railroads, but it appears logical to assume that in sections where longer life is obtained from ¼-in. copper-bearing steel, a correspondingly longer life can be expected from the thinner sheets of Cor-Ten.

High-Strength Steel and Welding

Cars No. 8 and 9 were both designed to carry nominally 70 tons of coal or 90 tons of ore. Both were built for the Bessemer & Lake Erie; No. 9 of carbon steel in 1931, No. 8 of Cor-Ten steel in 1936. Both designs are used in the same service, moving coal from the Pittsburgh district to their lake port and ore on the return trip. No. 8 carries about three tons more coal and five net tons more ore than No. 9. For each trip with coal, the railroad collects $5.43 and, with ore, $5.90 more revenue for Car No. 8 than for Car No. 9. This increased revenue alone should show a very good return on any premium paid for the Cor-Ten-steel car over the cost of the carbon-steel car.

Car No. 5 is a new design developed by the Railway Research Bureau of the United States Steel Corporation Subsidiaries. As of July of this year, only a sample car had been built but additional cars were on order.[2] In this design two modern developments, Cor-Ten steel and arc welding, are combined to offer a practical light-weight car having a very smooth interior for the free flow of lading. The side sheets consist of two strips butt-welded together, the uppersection being 5/32-in. thick and the lower, No. 8 gauge. The side reinforcing members are rolled sections and are applied on the outside of the sheets. The center sills consist of two pressed or rolled channel sections butt-welded together and welded to separate draft sills. The latter are the standard welded Z-section center sills.

Aluminum

Car No. 6 was developed by the Aluminum Company of America to utilize aluminum for body structure, except for center sills and bolsters which are of carbon steel. The bolsters are I-beam type and the center sills standard welded Z-sections. As of July of this year, this particular design had not been built, but aluminum hopper cars of other designs were in service.

Car No. 7 represents a composite design built in 1923. Wood has never met with much favor in hopper-car design, but it has been used quite extensively for sides and floors when steel plates for these were not obtainable.

Weight Economics

Minimum dead weight consistent with overall cost has been an objective of practically all designers. The table shows that in each succeeding period in the development, weight per cubic foot of coal-carrying capacity was decreased. Stated in other words, capacity was increased without increasing weight proportionately. The tabulated data also permit comparison of capacities and weights of cars built of carbon steel with those utilizing other materials in the construction of their bodies.

Almost everyone interested in freight cars knows that it costs real money to move dead weight but there does not appear to be agreement on what the actual out-of-pocket cost to the railroads is. These costs were analyzed some years ago by A. F. Stuebing, of the Carnegie-Illinois Steel Corporation, and by the Mechanical Advisory Committee to the Federal Co-ordinator of Transportation. The figures they arrived at varied from 0.619 to 1.944 mills per ton-mile. These figures are understood to have been based on operations in or about 1930. Since then, nearly all costs have advanced very materially and it is reasonable to assume that this cost is also much higher today than it was in 1930, and if train speeds are stepped up the costs will be still higher.

Whatever figure for this cost is accepted will be an important factor in determining what the railroads can profitably afford to pay for reduced dead weight, but not the only one to consider. Hopper cars are usually loaded to maximum capacity and because capacity is increased to the extent weight is reduced, railroads collect additional revenue on practically every load hauled. Also, hopper-car floor and side sheets wear out, due to the combined action of corrosion and abrasion, and are regularly replaced one or more times during the life of the car and an increase in the service life of these will reduce maintenance cost.

Reduced dead weight, increased capacity and longer life of parts may be obtained in hopper cars by substituting low-alloy high-strength steel or aluminum for carbon steel in bodies. The first mentioned permits re-

(*Continued on page 78*)

[1] See *Railway Mechanical Engineer*, January, 1935, page 11, for a description of this car.

[2] See *Railway Mechanical Engineer*, May, 1946, page 254, for a description of this car.

Locomotive

Boiler Performance*

By Fred D. Mosher†

Advances in efficient coal burning have been retarded by space restrictions which have limited the disposition of radiant heating surface

THE conventional locomotive firebox and boiler as we know it, because of the restrictions placed on the locomotive structure, has limited the freedom of the designer. Actually the locomotive boiler of 1947 is much the same as it was 50 years ago. The boiler is larger, more powerful, and certainly more expensive, but the body shape is the same. It is a case of convention controlling an art.

Reasons for continuing the common structure of the locomotive boiler are many and sound. As a power plant the locomotive does not get regular attendance during its working hours. Its utter simplicity permits men with limited knowledge to obtain full capacity from it in spite of extremely severe service conditions.

In the locomotive as a whole the boiler assumes the role of a backbone in that it is the main structure. It supports itself and provides stability. The boiler is reasonably durable and safe. Its fabrication is simple and its maintenance is such that ordinary skills can keep it functioning as a highly useful tool.

But because of the controlling factors in locomotive boiler design the result is a compromise of such magnitude that improvement in the performance of the plant has come wholly from devices brought to the locomotive boiler and which have had a material effect on its function of converting fuel energy into useful work.

In the period 1900 to 1947 boilers have been made larger and pressures have been increased so that 300 lb. per sq. in. is common. Improvements in front ends have been made by trial and error and some degree of standardization has been effected.

The greatest gains have been made through the adoption of combustion chambers, feedwater heaters and pumps, improved brick arches, water circulation through firebox, mechanical firing equipment, and the use of superheaters and steam dryers.

Unfortunately for the progress of steam power no rational methods of design have been established, and data are not available to permit an engineering approach to the design of modern steam locomotives. The so-called Cole ratios were never satisfactory. Even though Cole's evaporative ratios were never adequate their use has been continued in the design of modern locomotives.

The Cole ratios were developed as a result of the tests conducted by W. F. M. Goss at Coatesville in 1912. The major weakness in the Cole method of predicting locomotive performance lies in the fact that the firing rate is not given proper consideration; a secondary weakness lies in the scanty data on which the design proportions were based.

Today, 30 years after the Cole ratios were published, we still lack sufficient locomotive test information for the rational design of a modern locomotive. It appears now that Cole based his proportions on the boiler tested by Goss and that the formula produced by him applied only to that boiler.

Any set of proportions, design formulas, or tabled design data used in the calculating of expected locomotive performance will have to give due weight to firing rate, and locomotives with different firing rates will be found to have different performance characteristics. This factor must also be used as the sustained firing rate because that means most in locomotive performance.

Fig. 1 shows the difference in evaporation per square foot of grate per hour for locomotives of 30 years ago and a modern locomotive. There is a wide difference in

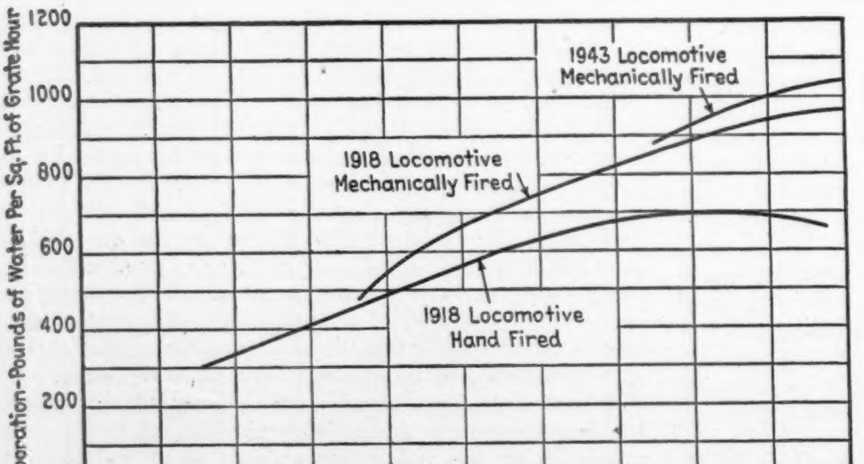

Fig. 1 — Relation between evaporation per square foot of grate per hour for locomotives of 30 years ago and modern power

* A paper presented at a Fuels Division session during the annual meeting of the American Society of Mechanical Engineers, Atlantic City, N. J., December 1-5, 1947.

† Research Engineer, Standard Stoker Company.

the characteristics of the hand-fire locomotive and the earlier mechanically fired locomotive, and this difference is due, to a great extent, to the fact that in one case firing is intermittent while the other is a sustained rate over the entire load range. As a contrast the modern locomotive is capable of sustained higher rates of evaporation at the higher loads. Attention is called to the characteristics of the hand-fired engine and the drop in rate of evaporation at the higher firing rate.

We ought to talk horsepower in connection with locomotives, since acceleration and power at sustained high speeds are the features of a locomotive that pay dividends.

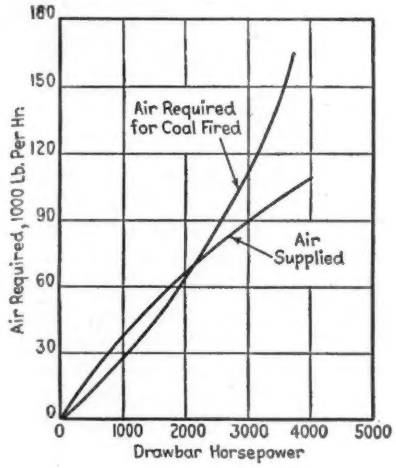

Fig. 2 (above)—The inadequacy of air supply on high loads is shown by the two curves in this chart

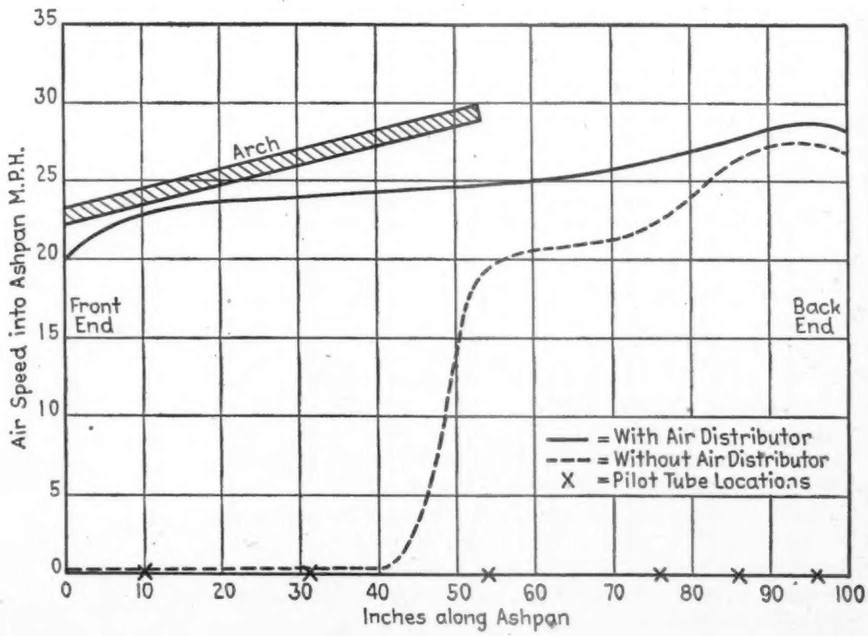

Fig. 3 (right)—Velocity pattern of air flow to firebox on a 4-8-2 type locomotive with and without air distributor at maximum locomotive speed of 60 m.p.h

In the boiler and firebox lie the greatest opportunities for materially increasing useful horsepower in the locomotive. Further improvements can be made in the utilization of the steam. Increased horsepower must parallel a decrease in the amount of coal fire per horsepower developed. This has been demonstrated over a period of years as locomotives evolved, and as appliances for the benefit of the locomotive were developed.

The accompanying table shows the reduction in fuel consumption per indicated horsepower-hour with a very steep rise in horsepower output on the Pennsylvania between 1904 and 1943. Further improvements in the way of increased horsepower can be made to existing locomotives through the use of knowledge available and the intelligent application of devices now at hand or in the process of development.

Advances in the efficient burning of coal on grates have come slowly because of the restrictions placed on the locomotive with respect to dimensions; these restrictions have limited the disposition of radiant heating surface which is a determining factor in boiler capacity.

Increase in Horsepower with Decrease in Coal Fired Per Horsepower

Year Built	Class	Indicated horsepower	Dry coal, fired, lb. per hr.	Coal fired, lb. per hr. per 1 hp.
1904	E-2A	1,200	6,000	5.0
1914	K-4-S	3,330	10,000	3.0
1943	T-1	6,500	16,500	2.7

Too few of us realize the importance of combustion air supply to the locomotive firebox. The ability of the conventional steam locomotive to provide air for the burning of its fuel determines its capacity as a steam generator. It is characteristic of the steam locomotive that it is under-supplied with combustion air at high rates. Fig. 2 shows the inadequacy of such air supply.

While certain possibilities exist with respect to more uniform quality of coal for locomotive fuel, which will require the co-operation of the coal industry, there are certain sections of the country to which this improvement will not apply for some time. But there are immediate prospects for improving combustion with respect to air supply. A study which was carried on during the war in Canada and more recently in this country has developed certain facts about the distribution of air to the underside of locomotive grates. This principle of undergrate air distribution has been established on locomotive road tests and confirmed by laboratory studies of air flow.

In locomotive operation the effect of speed causes the air flow into the ashpan to pile the air at the back portion of the pan so that velocities through the grates at this location are much higher than those through the front portion of the grates. The result is that burning becomes unbalanced with most of the coal being burned on the back portion of the grates. Where velocities under the grates have been redistributed through the use of a properly designed undergrate air distributor it has

been found that a reduction in coal consumption has been effected. The reduction varies from 7 per cent to 15 per cent depending on the design of the locomotive.

Fig. 3 shows the velocity pattern of air flow to the firebox with and without an air distributor. While these measurements were made in the ashpan, observations indicate that the pattern is repeated in the firebox.

To realize the benefits of correct undergrate air distribution it must be recognized that each class of locomotive requires special study because it has been found that the general arrangement of firebox, grates and arch have influence on the design of the distributor.

The highest penalty is paid by the locomotive in the form of back-pressure horsepower used to move combustion air and exhaust the gases of combustion from the front end. In all locomotives this back-pressure horsepower, is a large percentage of the horsepower developed by the cylinders and may be as much as one-third of the power output. Fig. 4 is characteristic of the back-pressure curve for conventional engines. The curve rises very steeply as the cylinder output reaches its maximum. In general one pound of exhaust pressure is equivalent to four pounds on the inlet side of the cylinder. The steepness of the curve is due to the fixed nature of the steam exhaust system and the fixed conditions of the gas passages.

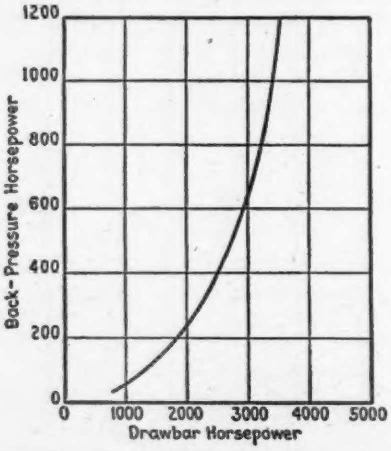

Fig. 4—Characteristic back-pressure curve for conventional locomotives

In the case of passenger-train operations where horsepower for acceleration is valuable horsepower, anything that can be done to release back-pressure horsepower for useful work is well worth while. Fig. 5 shows the drawbar-horsepower curve for a typical 4-8-4 locomotive and another curve showing the addition of the theoretical back-pressure horsepower for useful work.

Back pressure can be reduced to the absolute minimum only by eliminating the exhaust nozzle as a means of handling the draft requirements of the locomotive. For a number of years studies have been made with the idea of mechanically drafting locomotives, and several years ago tests were conducted. More recently this work was resumed with the experimental project on the Norfolk & Western.[1] This project went further than any previous work of this type in that automatic combustion controls were included, eliminating one of the previous objections of controlling the fan by hand. The successful development of a mechanical draft system for locomotives would add in the order of 15 to 20 per cent more drawbar horsepower to the steam locomotive. Other advantages such as uniform firing would be accomplished through the use of combustion controls.

[1] *Railway Mechanical Engineer*, August 1947, page 402.

Admission of secondary air to fireboxes, as shown by Kresinger, is necessary for the completion of the combustion process. Experiments have been carried on both in the laboratories and on the railroads for the past few years. Opinions vary widely among engineers as to the effectiveness of present methods to fulfill the purpose of secondary air. As in many other instances, when locomotives are concerned, there is no agreement as to the best means of doing the job. But the more than 2,000 applications of steam-air jets seems to offer justification for their use, particularly where objectionable smoke is a problem.

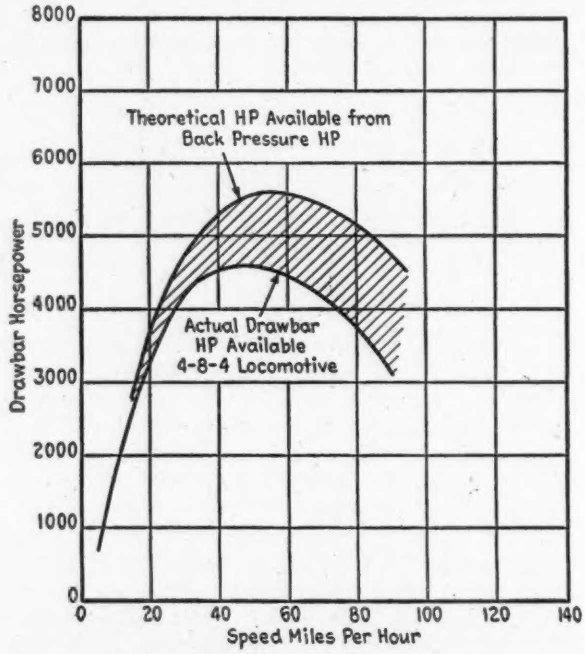

Fig. 5—Drawbar horsepower curve for typical 4-8-4 type locomotive and additional curve showing theoretical horsepower available from back-pressure horsepower

To round out the discussion of firebox and boiler performance it is well to note that increasing the capacity of present boilers will be offset, somewhat, unless cylinder performance is improved. One of the objections raised by those who would maintain the status quo with

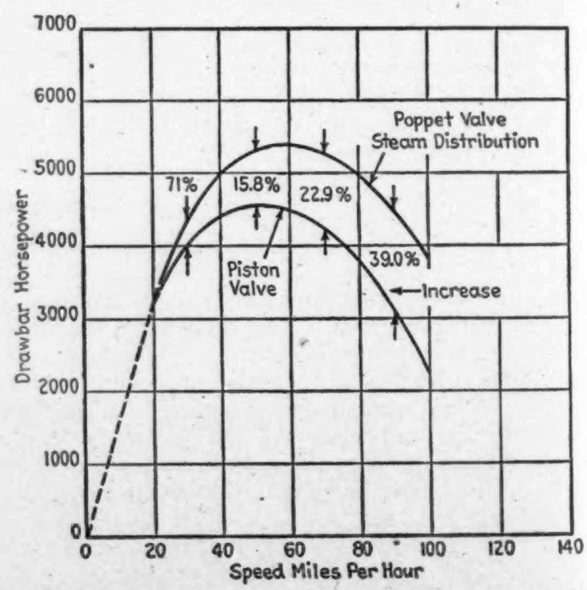

Fig. 6—Improved horsepower output over load range of 4-8-4 locomotive with piston and poppet valves

respect to improving locomotive boilers is that the inefficiency in the present method of utilizing steam nullifies the effects of better production.

But while progress has been made with respect to capacity and improved boiler performance, methods of bettering steam distribution in the cylinders have been refined and put in use. Sufficient experience has been gained to make these improvements immediately available to the railroads. During the past year poppet valves have been in service on a 4-8-4 locomotive of modern design. During a period when this locomotive was assigned to through passenger trains it broke the world's record for sustained monthly mileage. Fig. 6. shows the improved horsepower output over the load range of a 4-8-4 locomotive when poppet valves replace piston valves.

The most immediate prospects for improving the position of the conventional steam locomotive in the transportation field do not lie in attempting radical changes in design; the necessary data are not available for such designs. Improvements in any steam locomotive cannot be made through personal whim. Improved performance ought to be such that the industry as a whole benefits when new ideas are introduced or new tools for better utilization are developed.

Industry-wide cooperation which is now making headway through the joint efforts of railroads, coal producers, and equipment manufacturers will pay dividends in the future.[1] A program for the future should include the pooling of knowledge available, and the pooling of financial support to provide facilities for experimental work.

Data to be useful must be organized, classified and disseminated. The data, now lacking, for future design work should include information on higher steam pressures which is one of the possibilities open for improving the competitive standing of the coal-burning steam locomotive. We are almost barren of information on fuels which can be obtained only through research that has continuity. Whether or not such innovations in coal-burning as the cyclone furnace can be adapted for locomotive use may never be known unless such a program is undertaken by some cooperative group ably supported by the railroads and others who have a stake in the railroad industry. There is need for further research in coal combustion and the proper handling and distribution of air in the burning process. And in the search for improved boiler and overall locomotive performance in the future there must be included a materials research program so that when better equipment becomes available the materials to build it with will be at hand.

Locomotive Boiler Design

(Continued from page 69)

placed by simply cutting the two ends and welding a new element into place.

There will be a substantial increase in firebox volume as shown by Fig. 3. This will give improved combustion and less trouble from cinder cutting and slag.

Two circulating pumps would probably be used, each with sufficient capacity to operate the boiler. In case of failure of one pump, the other pump would automatically circulate all of the water necessary to bring the locomotive to the end of the run.

Forced-Circulation Boilers in Service

Although no forced-circulation locomotive boilers of the design described have been built as yet, there are approximately 2,000 forced-circulation boilers in operation in Europe in both land and marine service. A number are also in service in this country. One design which is of interest because it contains many of the features proposed for the locomotive boiler is shown in Fig. 4. This is a portable steam generator built in capacities of 2,000 to 6,000 lb. per hr. The water is taken from the drum to the circulating pump and discharged to an inlet header. This header feeds three elements or circuits in the furnace and four in the convection bank, with a metering orifice at the entrance to each circuit. The elements then discharge to an outlet header and the water and steam mixture is separated in the drum in a centrifugal type separator giving dry steam from the drum. As in the proposed locomotive design, the headers and elements are welded together to give sufficient structural strength and eliminate trouble from vibration. At the top of the boiler, the inlet and outlet headers are welded together and at the bottom they are connected by a substantial beam. This gives a strong backbone to the whole structure. The convection elements are welded to baffles which hold the tubing in place and at the same time baffle the gases. The adjacent tubes in the radiant elements are spot-welded to hold them in place and prevent distortion. The circulating pump supplies sufficient pressure to give efficient separation in the drum in the same manner as proposed for the locomotive.

The boiler controls are completely automatic. The boiler-feed pump is regulated by the water level in the boiler and the oil delivered to the burner is regulated in accordance with boiler pressure and steam demand. In case of failure of any of the auxiliaries which could cause damage to the boiler, the fuel supply is automatically shut off. The proper circulation of water through the steam-generating elements is indicated by the differential pressure between the circulating pump inlet and outlet. If this differential falls below a predetermined figure, the fuel supply is automatically shut off. A similar indicator would be used on the forced-circulation locomotive boiler to indicate the proper delivery of water to the firebox.

Power-Plant Installations

The largest forced-circulation boiler built to date was installed at the Somerset Station of Montaup Electric Company, Fall River, Mass., during 1940-42. The unit is designed to generate 650,000 lb. of steam per hour at 2,000 lb. per sq. in and 960 deg. F. with a design efficiency at maximum continuous load of 89.3 per cent. The size and shape of the boiler were determined by the floor space and head room available, and the decision to use forced circulation was made because the desired output could be obtained in a limited space.

The unit consists of a radiant furnace, primary and secondary superheaters, steam re-heater, upper and lower economizers and a Ljungstrom air preheater. Three circulating pumps are installed, but one of these is held as a spare. In normal operation two of the pumps are used, delivering approximately three million lb. of water per hour. One pump will furnish sufficient water for operation at a reduced capacity. The steam-generating elements are made of 1¼-in. O. D. tubing.

A unit built for the Koppers Company has a capacity of 350,000 lb. of steam per hour at 800 lb. per sq. in. and 750 deg. F. The unit consists of a radiant furnace, superheater, convection bank or secondary generator, economizer and air preheater. Two circulating pumps are provided, each of which has sufficient capacity to operate the unit at maximum output.

Hopper-Car Evolution

(*Continued from page 73*)

ducing weight and increasing capacity of the 50-ton car two to three tons and the 70-ton car a little more. With aluminum, a somewhat greater change is possible. Substituting either of these materials for carbon steel will increase the cost of the car, but change in price for the improved steel is quite nominal if no change is made in brake equipment.

The Braking Problem

In reducing the weight of hopper cars, the recommendations of the Committee on Brakes and Brake Equipment of the Mechanical Division of the Association of American Railroads for braking ratios need serious consideration. This committee recommends that all new freight cars shall provide a braking ratio of 18 per cent, preferably 20 per cent, of gross weight and Interchange Rule 3 requires that the braking ratio shall not be more than 75 per cent of the empty-car weight. To provide the minimum recommended ratio on gross weight and not exceed the maximum allowed on the empty car with single-capacity brakes, a 50-ton car must weigh at least 40,560 lb. and a 70-ton car, 50,400 lb. To provide the preferred recommended ratio on gross weight while not exceeding the limit for empty-car weight, minimum car weights become 45,100 lb. and 56,000 lb., respectively.

Dual-capacity and load-compensating brake equipments cost considerably more than single capacity brakes, and if their cost is added to the cost of reducing dead weight of hopper cars, the total may discourage weight reduction. Surely the Brake Committee was convinced that the braking ratios they recommend are necessary for safe operation and, if this is true, it would appear to be only a matter of time until what are now in the form of recommendations are changed to a mandatory requirement.

The committee prefers a ratio of 20 per cent gross weight on all new freight cars and if any new cars require this ratio it would appear to be the hopper cars. These, more than any other type, are regularly loaded to maximum capacity and frequently move in solid trains; also, very few hopper cars now in operation provide even the minimum braking ratio recommended by the committee. It would therefore appear that more efficient brakes should be provided on all new hopper cars and that the increased cost for providing these should not be considered a part of the cost for reducing dead weight. The only alternative is to increase weight and reduce capacity.

Adapt Design to Welding

Arc welding has been vastly improved in recent years and an all-welded car body is now possible that will offer railroads economies in both first and maintenance cost. Arc welding is certainly not new in car construction even if an all-welded body is considered so.

It has been successfully used for joining Z-section center sills and door frames in AAR standard hopper cars and on an increasing scale for securing other parts in this and other cars for over ten years. Throughout a similar period its use by railroads in repairing cars and salvaging parts has steadily expanded which proves its advantages for this work also. Most railroads have now had sufficient experience in arc welding and flame cutting to enable them to maintain welded bodies as cheaply as riveted constructions. Welded joints should also offer longer life in floor and side sheets by eliminating lap joints to trap coal dust and moisture which cause corrosion.

To realize all the advantages offered by the substitution of welds for rivets, and low-alloy high-strength steel for carbon steel in hopper cars, it is necessary to reconsider carefully all design details affected. Mere substitution of one for the other will not accomplish much, if any, improvement.

While developing standard designs for welded hopper cars at the earliest possible time has advantages, delaying their creation for a year or more for observation and study of the designs recently placed in service might result in better standard designs and possibly insure a wider acceptance.

Before undertaking standardization of the welded hopper car, efforts should be made to obtain the Interstate Commerce Commission's approval for securing brackets and supports for safety appliances to the car body proper with welds. Welds offer advantages for this purpose and appear to be the logical thing to do on a welded design. Safety Appliance Standards as now interpreted require these brackets and supports to be secured by bolts or rivets, but surely the art of welding has now been advanced sufficiently to permit prescribing welds which will assure trainmen every possible degree of safety afforded by bolts and rivets.

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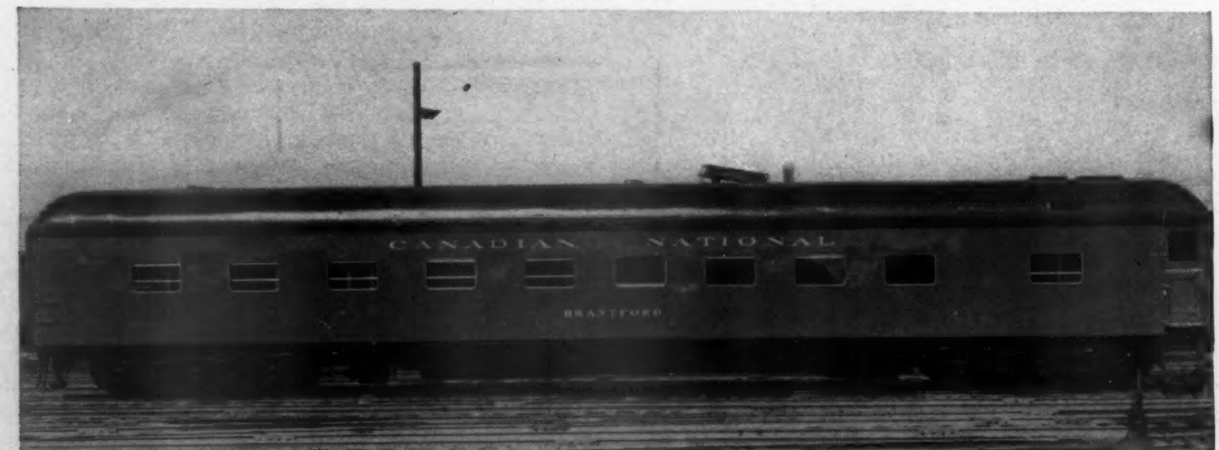


A new Canadian National all-room sleeping car

EDITORIALS

Electrification May Come Back

During the past few years, electrification studies were made with the result that Diesel-electric locomotives were purchased to fulfill motive power requirements. It is generally recognized that an electric locomotive can out-perform any other type, but apparently the engineers' findings did not show sufficient savings to warrant the long term investment required.

But it would be wrong to assume that this circumstance had deterred engineers, railroad operators and business men from giving further thought to the subject of electrification. At the winter meeting of the American Institute of Electrical Engineers held in Pittsburgh, Pa., during the last week in January, a symposium of papers on railroad electrification was presented. It is evidently the belief of the authors of these papers that the cost of electrification can be reduced sufficiently to warrant its application even on lines having relatively light traffic. Heretofore, it has been applied in this country only to meet the needs of the heaviest traffic, or to alleviate conditions caused by heavy grades and tunnels.

The A. I. E. E. papers divide the subject of electrification into its several components, namely, power supply, conversion and transmission, distribution, and motive power. Each author shows how the cost of the component assigned to him might be considerably reduced. A fifth paper, not included in the symposium, shows how shunt capacitors can be used to improve operating conditions with attendant savings. A sixth paper compares actual operating results of steam, Diesel-electric and electric motive power.

It is the opinion of some engineers that if the cost of electrification could be reduced one-third, it would find wide application in this country. In the face of rising costs, this might appear to be just wishful thinking. But costs are relative.

Now nearly all of the locomotives being made are Diesel-electric. Production of steam power is very small, and it has been necessary for manufacturers to mark up the price of steam locomotives sharply. Up to the present time, the cost of a Diesel is less than the cost of an electric, plus its share of the power-supply system. Electric power rates in most cases are such that existing electrifications do not show a saving in the cost of power. Rising prices of oil, however, may change this relationship, and more favorable power contracts are conceivable. The price of coal will undoubtedly follow the price of oil, but conceivably at a lesser rate. Power for electric locomotives is derived from hydraulic plants or coal-burning plants, where coal may be delivered to one point in large quantities. New designs may considerably reduce the cost of distribution systems. Atomic energy could be used in a power plant, but not on a locomotive. Maintenance costs of Diesels have not been fully determined.

Consideration of these circumstances and of others indicate that the continuing work of the electrification engineers should not be ignored.

Regional Repair Shops For Diesel-Electric Power

A chief mechanical officer of a road which operates a limited number of Diesel-electric locomotives, not confined to the designs of any one builder, has addressed a letter to this publication in which he suggests a type of Diesel-electric repair, servicing and storehouse facility that is sufficiently unique that we believe it worth while to incorporate it here rather than as a letter to the editor. His letter follows:

"In order that maximum efficiency may be had through reduced shopping time, together with greater savings to the railroads, there is a definite need to establish in every large railroad center an independent Diesel-electric service shop, together with a material storage warehouse, handling all Diesel parts, both mechanical and electrical.

"A greater benefit will be realized through a service shop of this character by handling all makes of Diesel-electric repair parts and to carry on heavy repairs that railroads are attempting through small inadequate facilities. This shop could be equipped with the most modern machinery to do work that railroads find necessary now to return to the original manufacturer. The Diesel locomotive manufacturer must be made conscious of the vast amount of money that is being spent to maintain a production unit by railroads which have never set up maintenance to take care of this type of equipment.

"Economics point to the utilization of such a facility in order that railroads may reduce their overhead and enjoy the maximum service obtainable through the use of Diesel locomotives.

"The locomotive manufacturers themselves have an opportunity, through a facility of this character, to reduce their inventory on a national basis, making available through such central distributing points items which are now carried by each and every railroad. Items such as spare engines, spare traction motors and generators may be carried on a unit exchange basis.

"I believe a plan of this character must be entered into by the railroads and Diesel manufacturers immediately and progress as fast as the Diesel manufacturing program is being done today in order to meet the demands that will be made by railroads through the next five years.

"This matter is not to be treated too lightly as at the present time at least 75 per cent of the Diesel locomotives now in service will not require a great amount of attention in the immediate future but looking into the future we will be faced with the same problems with respect to maintenance as we are with production today. It is a responsibility of Diesel manufacturers to the railroads to furnish the best possible service at the lowest cost and I believe this is possible only through facilities of this character. The manufacturer will reap equal benefit with the railroad."

The writer of the letter feels that in the interest of economy of operation and the reduction of the inventory of expensive parts for this type of power it is up to the railroads to initiate some such idea as this if it is considered the logical thing to do. We hold no brief for the proposal beyond a keen interest in the reactions that may arise both from the people in the railroad industry and the manufacturing and supply industry. There is one comment, however, that occurs to us: to those who may be inclined to brush this proposal aside as impractical it may be well to remember that the automotive industry, especially as related to trucks and buses, has operated somewhat along this line in so far as the supply and warehousing of standardized replacement parts is concerned.

Some Tips On Grinding

Experience in railway shops doing a large and varied amount of grinding in connection with equipment repairs has developed a number of suggestions which are not new but possibly need re-emphasis in the interest of improved grinding practice and getting the best results with modern grinding machines. The machines referred to include plain grinders of various sizes, with or without bed gaps or taper attachments for finishing such parts as locomotive and car axles, crank pins, piston rods, valve rods, crosshead and knuckle pins and a wide range of smaller motion work pins. Internal grinders are used for such large specialized work as refinishing cross-compound air compressor cylinders without disassembly from the center casting and smaller machines for grinding the innumerable small holes in bushings and other equipment parts which must be finished accurately on a high-production basis.

Face grinders render valuable service for finishing both new and worn guides and many other parts such as thin-wall journal boxes which need an accurately machined surface around the opening for the cover fit. It is difficult to do this job on either a planer or milling machine without chatter and loss of metal cutting time as the planer tool or milling cutter passes over spaces within and between individual journal boxes as set up on the work table. Link grinders are almost indispensable for finishing valve gear links and link blocks, and swing grinders serve many useful purposes, a good example of which is the removing of all surface defects and sharp corners on driving rods to assume reliability and freedom from failure in service. Tool grinders and floor grinders are essential in every shop and car-wheel tread grinders are saving their cost many times over in finishing treads concentric with the journals and by grinding out small flat spots on worn wheels.

In any attempt to secure improved results in grinding, the machines themselves require first consideration as they are for the most part high-precision tools in which the grinding wheel spindles and bearings are the most important single units. Many elements in the condition of machines and their method of operation have a bearing on the accuracy, finish and production rate of work turned out, but none of these objectives can be achieved unless the spindle bearing adjustment is just right; i.e. not tight enough to run hot but sufficiently close-fitting to run a little warm up to hand-bearing temperature and thus assure absence of any possible slack or lost motion in the bearing.

Particularly with large grinding wheels operating at high speeds, the question of wheel balance is fundamental and may require re-adjustment more than once during the life of a single wheel, as the wheel structure is not necessarily homogeneous throughout and the wearing away of relatively dense or lightweight spots near the periphery of an accurately-balanced wheel may throw it out of balance. Another fact sometimes overlooked is that grinding wheels are porous and water absorbent and it may be necessary to spin large wheels for several minutes before shutting down a grinder at night and throw off all possible excess moisture. Otherwise the water will settle in the bottom half of the wheel to such an extent that the wheel will be definitely out of balance when started the next morning.

Attention to work-center condition and alinement is important, also the method of driving work, and steady rests are of course required in grinding all long pieces. At one railroad shop where trouble was experienced with slight marring of finished crank shaft bearings with steady rests, the original hard wood blocks were covered with copper facing which also caused scratches due to small particles of abrasive becoming imbedded in the relatively soft copper. The same result in somewhat less degree was found with hard bronze facing. Best results were finally secured with cast iron steady rest blocks, covered with canvas strips.

Wheel selection with due consideration to the material to be ground, wheel and work surface speed, amount of feed and kind of finish desired is of course fundamental. In general, vitrified aluminum oxide wheels are used for grinding high-tensile steels and silicon carbon wheels for materials such as cast iron, aluminum, bronze, etc. Finish is determined largely by the grain of the wheel and the grade selected depends upon the kind of material being ground. Both the finish and accuracy of the work are dependent upon using wheels carefully trued with a diamond dresser. The right kind of coolant, in generous supply to carry away heat from the work as fast as it is generated and

also flush wheel and work particles from the face of the wheel, is also important.

Grinding machine operators should keep in mind that the surface speed of wheels decreases rapidly with wheel wear and step up spindle speeds in proportion. Another interesting fact is that wheels tend to act softer as speed decreases and harder with increased speed. One of the most important suggestions is to utilize fully the specialized experience of individual grinding machine manufacturers whenever desired results are not being obtained. The manufacturers have a definite interest and responsibility in the performance of their machines and generally give advice without obligation.

Give Machine Tools a Chance

In any railroad shop, whether for repairing steam or Diesel locomotives, freight or passenger cars, modern high-capacity machine tools, while the basic and most important factor in attaining maximum productivity and efficiency, are not the only factor in obtaining high quality, low cost repairs. Efficient machinery in a railroad shop can be considered analogous to the foundation of a building. Essential and important as the foundation is, completion of the structure is necessary before full advantage can be taken of the installation of the foundation. The same thesis is true in a railroad shop with respect to up-to-date machinery, which is rendered largely non-effective until an adequate supply of jigs, fixtures and convenient work-handling, holding and clamping devices are provided.

Machining time is only one part of the total time required to do a complete repair job. While machine work usually takes the largest portion of the total job time, in the majority of repair jobs a substantial proportion of the total overhaul time is consumed in setting up the work in the machine. In some cases, the set-up time equals or exceeds the machining time. For example, a job may require two hours for setting up and two hours for machining. Reducing the machining time by 50 per cent will reduce the overall repair time of four hours by only one hour, or 25 per cent. This not only fails to show the machine in its true light, but an expensive piece of shop equipment, as well as the car or locomotive appurtenance being repaired, is required to remain idle at least two hours for every hour of work that is performed. This is wasteful where machines are already installed. Worse yet, however, is the situation where, because the machine would work only one hour out of every three, the railroad is unable to justify its cost and thereby continues the use of obsolete machinery.

A saving measured in either hours or man-hours is of equal value whether made in machining time or in set-up time. In either case labor costs can be reduced and production increased. A saving in set-up time offers the additional advantage of reducing the idle time of an expensive shop tool. The amount of money that justifiably may be spent for reducing set-up time should, therefore, be determined not only by the increased utilization of present machines that better fixtures render possible, but upon the justification thus presented for buying additional modern machinery.

Holding fixtures which keep pace with improvements in machinery are essential in any type of shop if maximum production and minimum cost are to be attained. This is especially true in railroad shops because of the large volume of heavy work performed. For this reason careful thought should be given to improving fixtures on existing high-capacity machinery, and, when contemplating new machinery, as much consideration should be given to adaptability of a machine to efficient jigs and fixtures as to its productive capacity.

NEW BOOK

1947 STANDARD WELDING SYMBOLS—*Published by American Welding Society, 33 West Thirty-ninth street, New York 18. 67 pages, 5¾ by 9 in., illustrated. Price 50 cents.*

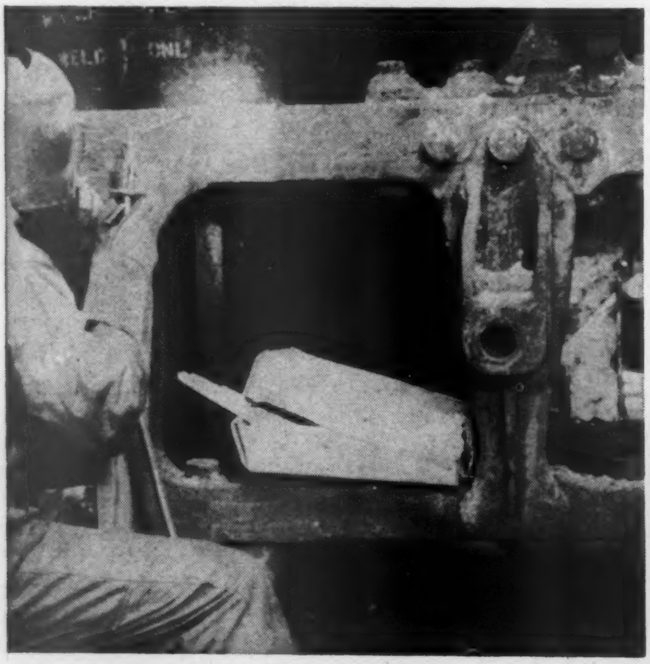
Through the years the user of the various welding processes has been confronted with the problem of using new welding processes without access to a standard set of symbols adaptable to every process in use. Such a set of symbols should be flexible and yet precise, so that any person reading them cannot possibly misunderstand what the designer has specified. In establishing the 1947 Standard Welding Symbols, the American Welding Society's Committee on Symbols has carefully considered these problems, and rules have been adopted which adequately provide for all the needs of management, the designer, and the shop man. The 1942 symbols, and earlier publications which date back as far as 1929, were concerned only with gas, arc and resistance welding. The revised edition of the symbols, however, covers 34 of the processes used in various industries throughout the country. It should meet the needs of industry very satisfactorily, since the personnel on the committee represents every fabricating industry using welding as a production tool. In the 1947 Standard the method of presentation has been revised from a form of rules, as presented in the 1942 standard, to a step-by-step presentation in lecture-type form. In addition, the rules have been expanded to include a means of indicating welds having root penetration. Other features are the dropping of the confusing terms "near side" and "far side" from the nomenclature, the addition of 45 illustrations showing the various applications of the symbols, and a chart which provides a compact summary of the use of the welding symbols for ready reference. It is expected that inspection symbols, which are now being considered, will follow the general pattern of the welding symbols, so that combined welding and inspection symbols can be indicated on a drawing. In order to reassure users of the standard symbols, the Committee on Symbols has adopted a policy which will keep changes to a minimum.

IN THE BACK SHOP AND ENGINEHOUSE

Arc Welding Broken Locomotive Frames

*By A. L. Havens**

The heaviest and most important part of a locomotive is the frame and broken ones can be repaired with a minimum of dismantling by arc welding, oxy-acetylene welding or brazing. The heavy steel member running from beneath the cylinders to the extreme rear or foot plate of the locomotive varies in width and thickness



Hobart Brothers Co. photo

Completing weld on broken 6-in. by 6½-in. locomotive frame section —Prior to arc welding the break was cut away and the metal was veed out from both sides.

from 4½ in. to 7 in. wide and from 5 in. to 13 in. thick or deep. One of the toughest jobs the railroad welder has is a broken locomotive frame. Sometimes these breaks occur in a section previously welded by the bare rod or some other process, and this makes it necessary to remove a large piece of the frame before repairing. The faulty section is cut away with the cutting torch and a new section is cut to fit. The new piece is then fitted into place and clamped securely. When all the oxide is removed by chipping or grinding, the vees are welded with heavy coated electrodes by one or two operators and the frame is made as good as new. There are a few common sense precautions that must be followed in addition to the previously mentioned cleaning of the vee, which is imperative.

When the break is welded by two operators, the root of the weld should be closed as soon as possible and the weld sloped to give a side hill effect. This will allow the slag to flow to the back of the weld and make it easy to remove. An oscillating bead is faster than single string beads, but the electrode should not be moved more than three times its diameter. For both speed and economy the largest diameter electrode permissible should be used. It is not uncommon to use 5/16-in. electrodes on a heavy section. Annealing the weld is not absolutely essential; however, there are stresses locked up in any weld of this type and heating the metal to a dull red does relieve the stresses and tend to make a more successful weld.

A case history which reveals somewhat the adaptability of arc welding locomotive frames occurred 11 years ago in a small eastern railroad shop where an inspector discovered a fracture in the frame of a large Mikado-type engine. This break was underneath a cylinder in a most inaccessible place. The frame in this location was 6½ in. by 12 in. and was completely covered on the back side by the cast iron cylinder. This made it necessary to vee the break all from one side. As the break occurred between the saddle bolts, ther was no room for expansion and no possible way to reheat without the danger of cracking the cylinder.

This frame required 12 hr. of continuous welding with ¼-in. electrodes. Each bead of the vee was cleaned thoroughly and peened after which a slight reinforcement was applied. This reinforcement was applied about ⅜ in. thick in the heaviest part and tapered both ways to a point about 1 in. over the extreme edge of the vee. The locomotive was back in service in a short

Hobart Brothers Co. photo

Breaks in hard-to-reach places are veed out with the cutting torch and welded with heavy coated electrodes

* Shop foreman, Rutland.

Hobart Brothers Co. photo

Broken 6-in. by 6½-in. locomotive frame prepared for arc welding—The faulty section in this case is cut out completely and replaced by a new flame-cut section

time and the weld is still as good today as when made. This is a splendid record for a weld of this type. Not all welds made in this manner are satisfactory but enough of them are that this is standard practice in most shops. Sometimes a temporary repair of this sort is made to keep a locomotive in service for a short period. Later, the locomotive is brought into the shop and the doubtful section is removed and a complete new section is welded into place.

Questions and Answers On Locomotive Practice

By George M. Davies

(This column will answer the questions of our readers on any phase of locomotive construction, shop repairs, or terminal handling, except those pertaining to the boiler. Questions should bear the name and address of the writer, whose identity will not be disclosed without permission to do so.)

Types of Stainless Steel

Q.—What is meant by the term 18-8 stainless steel? Do all 18-8 stainless steel plates have the same properties?—F.E.D.

A.—Stainless steel is a term popularly used to designate all stainless alloys, and many different types are put out by various companies under different trade names. Most of these have been classified and given standard type numbers by the Iron and Steel Institute. The chrome-nickel types, containing approximately 17 per cent or more chromium with 7 per cent or more nickel, are soft and tough as welded, harden quite rapidly when cold-worked, are nonmagnetic and cannot be hardened by any form of heat treatment; in fact, quenching from 2,000 deg. F. merely softens them and this treatment is used to put these steels in the best condition to resist corrosion.

The straight-chrome types, containing 12 per cent or more chromium with no nickel, are brittle as welded, do not respond to annealing, do not harden much with cold working and are magnetic. There are a variety of analyses under each of these classes; the most common and widely used is the 18-8 variety having approximately 18 per cent chromium and 8 per cent nickel. There are various types of 18-8 stainless steels, the most common being the American Iron and Steel Institutes Type Nos. 302, 302-B, 303, 304, 305 and 306.

Some of the more important properties of annealed 18-8 stainless steels are:

Tensile strength, lb. per sq. in.	85,000–95,000
Yield point, lb. per sq. in.	30,000–40,000
Elongation in 2 in., per cent	50–60
Reduction of area, per cent	60–70
Hardness, Brinell and Rockwell B, resp.	135–180 and 77–90
Izod impact, ft.-lb.	80–120
Specific gravity, grams per cu. in.	7.86
Specific heat, cal. per deg. C. per gram	.12
Thermal conductivity, per cent of low-carbon steel	33
Electrical resistance, ratio to low-carbon steel	6.4
Thermal expansion, ratio to low-carbon steel	1.45
Modulus of elasticity, lb. per sq. in.	28,000,000–30,000,000
Melting point, deg. F.	2,560
Approx. scaling temperature, deg. F.	1,650 (Average in air)
Endurance limit	Fatigue value is usually 40 to 45 per cent of ultimate strength. Ultimate is given for annealed metal. Work hardening will increase ultimate.

Causes of Cinder Cutting

Q.—What causes cinder cutting of the smoke stack? On our Pacific-type locomotives we are starting to have considerable trouble with the stacks cinder cutting through the casting, although no changes have been made to the front end or the bore of the exhaust nozzles of these locomotives.

A.—Cinder cutting of the stack could be caused by the grade of coal being used; coals with a heavy content of silica, earth and shale are a direct cause of cinder cutting. Other direct causes of the cinder cutting of the stack are: Smoke stack out of line with exhaust stand, rough castings, overlapping of the joint of the smoke stack and the smokestack extension, and smoke stack too small in diameter in relation to flue gas area of tubes and flues.

Defining a Locomotive Failure

Q.—What is properly considered a locomotive failure?

A.—Any delay to a train or reduction in tonnage on account of its locomotive breaking down, running hot, not steaming on account of condition of locomotive, enroute or at a meeting point, junction connection, or terminal after it has been reported ready for service, will be considered a locomotive failure.

The following will not be considered as locomotive failures:—

When a locomotive loses time and afterwards regains it without delay to connections or other traffic, or when delayed from other causes, as well as from its own condition, and makes up as much time as was lost on account of its condition.

Delays to passenger trains when they are less than five minutes late, or to scheduled freight trains when they are less than twenty minutes late, at terminals or junction points.

Delay when a locomotive that is working satisfactorily is given tonnage in excess of its rating and stalls on a grade.

Delays on extra or non-scheduled freight trains if the run is made in less hours than the number of miles divided by ten.

The locomotive steaming poorly or the flues leaking on any run where a locomotive has been delayed for other cause than defects of the locomotive, either on side tracks

or on the road, for an unreasonable length of time, or fifteen hours or more per hundred miles.

Reasonable delay in cleaning fires and ash pan on road.

Failure of locomotive coming from outside points to shops for repairs or wash-out, whether running light or hauling train.

Delays due to insufficient time having been allowed in which to make repairs or to get the locomotive ready for the time the train is ordered to leave if the operating department was so advised at the time the locomotive was ordered.

Broken draft rigging on engine or tender, when caused by the train parting or by the air brakes being otherwise improperly set from the train, delays to trains when weather conditions are such that it is impossible to make time, and delay due to the locomotive running out of fuel or water, as a result of being held between fuel or water stations an unreasonable length of time.

Engines running through over two or more divisions with the same train will not be charged with more than one failure per trip on account of the same defect.

Building Up Locomotive Multiple Guides by Welding

Worn multiple guides, made of S.A.E. 1045 steel, are rebuilt at one railroad shop, as shown in the illustrations, with medium-carbon welding rods by use of the Unionmelt welding process. The rod is laid on in a deposit about ¼ in. thick and from ¼ in. to ⅜ in. in width, after the guide has been preheated to about 425 deg. F. Welding speeds vary from 15 to 22 in. per min. The heat of the welding action holds the guide at the proper temperature.

Eight separate surfaces are rebuilt. The bottoms and tops of the slots are built up by placing the guide in a horizontal position and feeding in the welding rods vertically. To build up the side surfaces of the guide, the piece is positioned so that these surfaces are about 25 deg. from the horizontal. With the guide in this position the Unionmelt welding head feeds in the welding rod at about 18 deg. from the vertical. Because it is not possible to obtain sufficient cover of the granulated welding composition by gravity feed, it is distributed with a hand scoop before each pass is made. As each feed of deposited metal must be laid down accurately in position, a special fixture is added to the nozzle; this fixture rides on top of the guide and has an adjustment screw which controls the position of the welding nozzle.

After the surfaces have been built up, they are machined to proper dimensions and then flame-hardened. The guide is lowered past the multiple flame heating head and a water quench simultaneously applied. The flame hardening produces a surface hardness of 700 Brinell.

Flame hardening the guide after it has been machined to size

The guide positioned for depositing metal on the slot sides with the nozzle held in place by a fixture which rides on top of the guide

Air Brake Questions and Answers

The 24 RL Brake Equipment for Diesel-Electric Locomotives—Parts of the Equipment—Locomotive A Unit

D-24—Control Valve (continued)

614—*Q.—What parts does the Service Portion contain?* A.—(a)—Service piston *94*, (b)—service slide valve *102*, (c)—service graduating valve *103*, (d)—service piston return spring *109* and cage *108*, (e)—service piston spring *98* and guide *97*, (f)—two charging chokes *83* in the piston bushing, (g)—charging change over cock *157*, (h)—auxiliary reservoir check valve *89*, (i)—emergency reservoir charging check valve *89* and ball check *88*, (j)—release insuring valve portion, (k)—

release interlock valve portion, (1)—release piston *110*, and strainer *85*.

615—*Q.—How does the service piston function?* A.—The service piston moves in its bushing in accordance with variations in air pressure across the piston head, thereby controlling charging of auxiliary and emergency reservoirs.

616—*Q.—How does the service slide valve function?* A.—The service slide valve, which is attached to the stem of the service piston by pin *106* and lock *107*, moves with the service piston to establish the required port connections on the various positions.

617.—*Q.—How does the service graduating valve function?* A.—The service graduating valve which is shouldered on the piston, moves with the service piston to establish port connections in the various positions.

618—*Q.—What is the purpose of the service piston return spring and cage?* A.—To prevent movement of the service piston beyond release position unless pipe pressure is about 3 lb. higher than auxiliary reservoir.

619—*Q.—What happens in this event?* A.—In this event brake pipe pressure under the graduating valve is cut off by the slide valve to prevent the possibility of blowing the graduating valve off its seat.

620—*Q.—What does the service piston spring and guide provide?* A.—Stability of quick service activity.

621—*Q.—How is this accomplished?* A.—By preventing movement of the service piston to preliminary quick service position until a predetermined difference in pressure between the brake pipe and auxiliary reservoir is attained.

622—*Q.—How do the two charging chokes in the Piston bushing function?* A.—To control the charging flow of brake pipe air to the auxiliary reservoir, one of the choke ports is cut off in the service piston Retarded Recharge position due to the service piston seal on its back stop.

623—*Q.—What is the duty of the charging change-over cock?* A.—To determine fast or retarded charging, or charging of the auxiliary reservoir.

624—*Q.—How many positions has this cock, and what are they?* A.—Two; freight and passenger.

625—*Q.—How are these positions indicated?* A.—Cast letters on the body of the cock "FRT" and "PASS" indicates the two positions.

626—*Q.—Describe the flow of air in the two positions?* A.—In FRT position the recharge is retarded through chokes *83;* in PASS position it is augmented by flow through choke *81*, providing a faster rate or recharge.

627—*Q.—What is the purpose of the auxiliary reservoir check valve?* A.—The auxiliary reservoir check valve, above choke plug *81*, permits brake pipe air to charge the auxiliary reservoir when releasing and as controlled by change-over cock, cut prevents any back flow of auxiliary air.

628—*Q.—What is the purpose of the emergency reservoir charging check valve and ball check valve?* A.—To permit charging flow from auxiliary reservoir to emergency reservoir with the release piston and slide valve in release position, but prevent back flow from emergency to auxiliary reservoir except as controlled by the release interlock slide valve during recharge.

629—*Q.—What is the duty of the release insuring valve portion?* A.—This portion operates to release the brake when brake pipe pressure exceeds auxiliary reservoir by more than two pounds.

630—*Q.—What does this portion consist of?* A.—A release insuring cap in which is contained a release insuring valve normally held seated by a spring, closing a connection from the service slide valve. A follower is in control with a release insuring diaphragm.

Steam Generator Questions and Answers*

Q.—What will cause coils in the heat exchanger to collapse and how can it be avoided? Is it caused by temperature changing from hot to cold? A.—Collapsing of heat exchangers is not affected by temperature change. It is generally caused by a stuck water-relief valve which allows pressures to build up far beyond normal if the coil inlet valve should happen to be closed. We now have a new smaller-diameter heat exchanger which will withstand a much greater pressure and is more efficient. (Ordering Reference: Part No. (B-4225-KA3)

Q.—What is the fuel consumption per hour on the two types of steam generators? A.—The DK-3000 steam generator is approximately 35 gal. per hr. and the DK-1600 approximately 20 gal. per hr.

Q.—In your instruction book you mention that instead of draining a boiler a suitable anti-freeze might be used. We have road and switch locomotives that may occasionally be used as passenger locomotives. What suggestion do you have as to the type of anti-freeze that can be used to avoid having to drain these boilers when the engines are not used in passenger service? A.—Alcohol, Prestone or the like.

Q.—How long do you feel it takes to drain a boiler? A.—It can be blown out with air pressure in about one hour.

Q.—If a supply of anti-freeze were available, why couldn't it be flushed out thoroughly? A.—It could.

Q.—In the event that you use something that would mix completely with water, such as alcohol, would there not be the danger of an explosion when the boiler was fired? A.—There should be no danger of explosion, although before lighting the boiler water should be allowed to circulate through the coils for about ten minutes.

Q.—In your travels on the various railroads, have you had any experience with engines where an anti-freeze was used? A.—Not that I recall.

Q.—What would the objection be to a brine solution? A.—It would cause too much corrosion.

Q.—On the DK-4530 we have had experience where the control was erratic and it could only be corrected by installing a new water pump. What would cause that? A.—Erratic servo-control is usually caused by erratic water pump delivery due to a suction leak, bad valves or packing.

Q.—On the CFK boiler, how would you determine the suction leaks? A.—The easiest way is to open slightly the water pump test valve and observe if air is present.

Q.—What is the cause of the difficulty in lighting the No. 4530? A.—Generally the improper setting of spark plugs or air damper adjustment.

Q.—Would the addition of another set of spark plugs in the burner overcome this difficulty? A.—No. This has been tried without satisfactory results.

Q.—Is the spark set to catch the fine spray? A.—Yes.

Q.—On the new-type air solenoid the air feed is in constant operation. What is the purpose? A.—To keep the nozzle cool on the off cycle and prevent carbonization.

Q.—With the water progressing upward there is naturally some lime or solids. What becomes of the solids when you eventually get air that is perfectly dry? Is there any solution that could be used to reduce the amount of deposit in the water? A.—These conditions would call for proper water treatment.

*** Questions and answers submitted following a paper presented at the November meeting of the Northwest Locomotive Association by Roy Armbrust, Vapor Car Heating Company. All Model Numbers mentioned refer to Vapor products.**

Q.—It was stated that the water pump was packed with four turns of Chevron packing. Is this the practice for all types of pumps, as we have used three turns and it worked successfully? A.—We now recommend the use of four Chevron packing rings.

Q.—What has to be done when turning on the steam generator to "run" position and manifold pressure does not come up? A.—It would be necessary to bleed the air from the delivery side of the pump. This can also be accomplished by turning the operating switch to "run" and allowing the air to bleed out through the nozzle.

Q.—Have you run across any road that uses any compound in the fuel oil to cut down the carbon? A.—The steam generator will not carbon up if it is operating properly.

Q.—We overhauled a fuel control valve and we maintained 7 lb. with two relays and 28 lb. with five relays, but could not maintain water level. A.—This difficulty would indicate a plugged fuel nozzle or the steam trap orifice restricted.

Q.—Is there a way of testing the steam trap without taking it apart? A.—Yes. Turn the boiler to "fill" a few moments, then back to "run," and the trap should be able to carry off about two quarts a minute at normal boiler pressure.

Q.—What is the proper speed for a CFK? A.—Water pump speed for the CFK type unit is about 1,175 r.p.m.

Q.—On the DK-4530, when installing new servo-fuel controls they are stamped, tested and approved. Why are they stamped in this manner when they have to be adjusted when applied? A.—Servo will have to be adjusted to the boiler when applied.

Q.—In regard to the construction of the servo-fuel, we have found that some of the switches that shut off the air have springs that break, and some of the plates are warped and leak considerably. A.—This condition is now being corrected in production.

Q.—We have experienced difficulty on the high-temperature switches on the CFK. We cannot tell when they are kicking out. Is there some way we can determine if the generator is running with superheated steam? A.—If you observe a rise in feedwater temperature traveling through the heat exchanger to the coils, this would indicate that it is not superheating.

Q.—On the CFK we have had trouble with burned firing pots. Deflectors have been placed on top of stacks and this has not eliminated the trouble. What has caused that? A.—To correct this condition it would be necessary to inspect thoroughly the fire pot, air ring, smake hood and refractory sealing cement, and to replace all warped parts to allow proper air distribution.

Q.—Are firing pots and central cones supposed to last indefinitely, or do they have a specified length of time that they should last? A.—Short life due to warping is not a normal condition, and the cause should be corrected.

Q.—What does the Vapor Company think of discontinuing soot blowers and using Oxi as a soot remover. A.—We are in agreement with the discontinuance of soot blowers.

Q.—Does the air intake get all of its air supply from the outside, or is some taken from the inside? A.—In almost all cases air is taken from an outside source.

Locomotive Boiler Questions and Answers

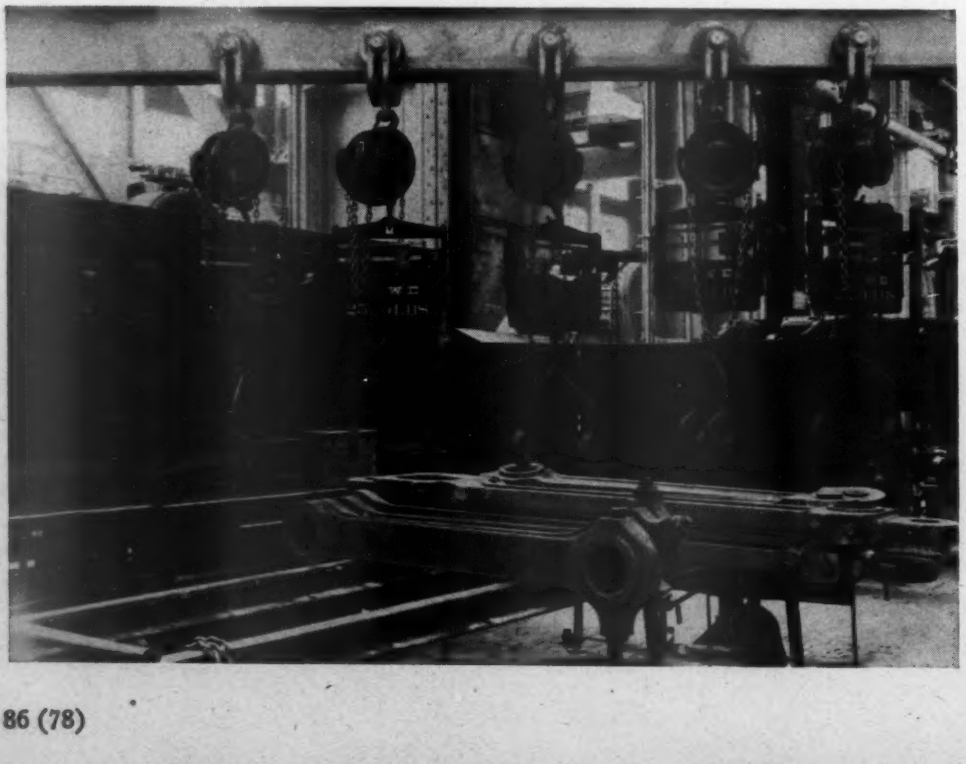
By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Tolerances for Staybolts and Holes

Q.—When applying staybolts we have difficulty with the staybolts stripping the threads on the inside sheets. This is no doubt due to the fact that the pitch of the threads on the staybolts is not uniform and, with a five- to seven-inch space between the sheets,

* * *



Five Howe 2,500-lb. scales supported by Yale chain blocks from a 26-ft. jib crane and used for weighing coupled connecting rods preparatory to determining necessary driving-wheel counterweights at the Paducah, Ky., shops of the Illinois Central

this variation in the pitch causes the trouble. Are there any standard tolerances for threading staybolts and tapping staybolt holes that we could adopt to correct this condition?—B.E.K.

A.—The threading of staybolts must be done accurately. On an ordinary threading machine, without a lead screw, a loss of one thread in six to eight inches of length is possible; the die can be sharp, yet the drag will cause the loss. The result of this missing thread is the cause of tight and stripped staybolts. It is necessary to check the pitch of the threads every 25 to 30 bolts threaded to keep the pitch as close as possible.

In threading staybolts it is important to have machines which have center lead screws, so the pitch of the threads of the bolts when completed will be cut to a tolerance of .0015 in. plus or minus per inch. Where possible, in order to check the bolts properly for the form and pitch of the threads, a comparator type of machine should be used. In addition to the method of checking with a comparator the operator should have simple gauges to make continual check on threaded bolts.

Eliminating Rear Waist Sheet

Q.—We have in service nine Consolidated locomotives having two waist sheets and waist-sheet angles fastened to the under side of the barrel of the boiler. Recently we experienced a cracked boiler at the waist sheet angle near the firebox due to the pull of the waist sheet during expansion and contraction of the boiler. After patching the boiler, we left the waist sheet off. There are expansion pads or shoes in front of the firebox which ride on the frame. Would the elimination of this waist sheet endanger the other supports?—G.F.L.

A.—The elimination of the rear waist sheet would not necessarily be of any danger, provided the boiler is otherwise amply secured at the cylinders, the guide yoke and the front and rear of the firebox. Although any support given by the waist sheet to the boiler and the frames at this point would be removed, it should soon become evident if the effect is detrimental to the performance of the locomotive.

The general practice, where waist-sheet angles riveted to the boiler have caused cracks in the boiler shell, has been to eliminate the rigid construction by freeing the angle from the shell and applying a wear plate between the angle iron and the boiler.

Fig. 1 illustrates a typical patch applied to the boiler shell at the waist-sheet connection. The waist-sheet angle rests against the wear plate, which is studded to the patch.

Fig. 2 illustrates the application of the wear plate to the shell of the boiler, without the patch. This application can be made at any time, eliminating the cracking of shell course without eliminating the waist sheet.

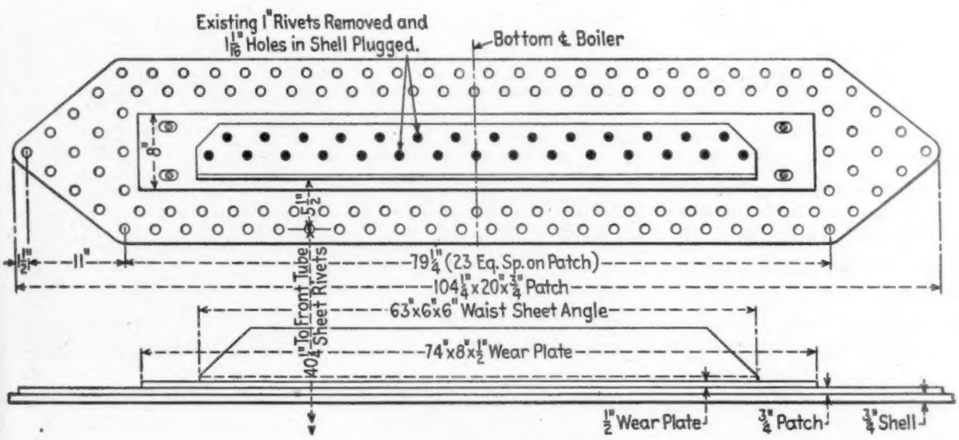


Fig. 1—Patch applied to the boiler shell at the waist-sheet connection

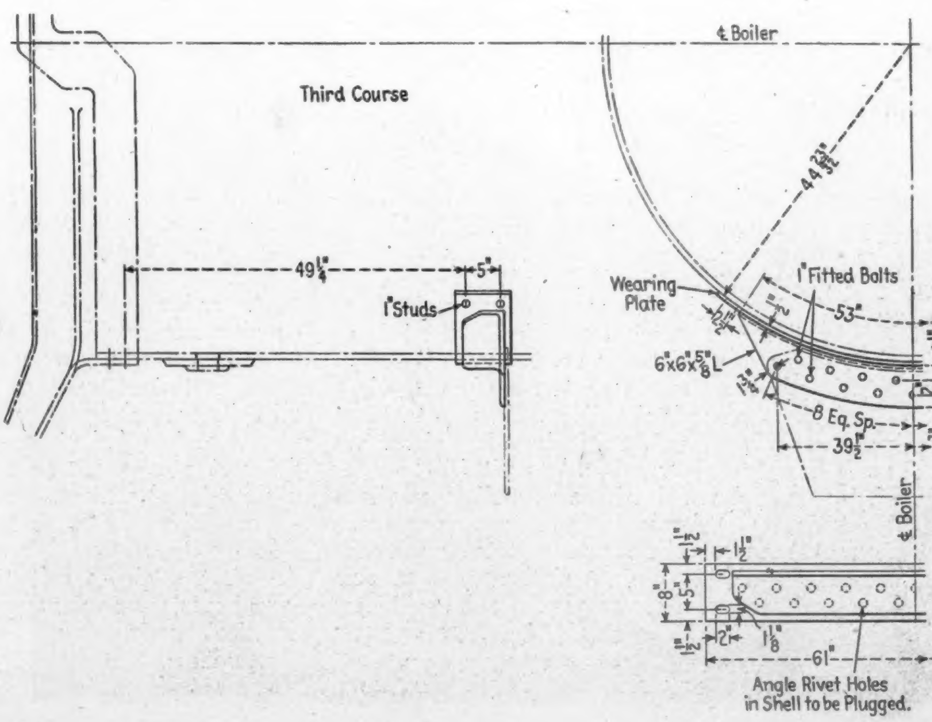


Fig. 2—Application of wear plate to the boiler shell which eliminates cracking of the shell course without eliminating the waist sheet

With the Car Foremen and Inspectors

Modern Freight Car Inspection Facilities

In connection with the recently constructed gravity-type classification yard of the Union Pacific at Pocatello, Idaho, primary interest for car men centers around the facilities for inspecting freight cars while in motion. As cars are pushed from the receiving yard up toward the crest, they pass a point at which one inspection pit centered between the rails and another pit and overhead inspection station on each side permit a five-man inspection crew to note defective conditions on the top, bottom and both sides of each car as it passes the inspection station.

The center inspection pit is a concrete enclosure, 4 ft. wide by 6 ft. long with a steel and glass enclosed top extending 2 in. above the rail top. Two windows, made of shatter-proof plate glass, 24 in. by 4 ft. permit a car inspector in this position to look both up and down the track in examining the underparts of car trucks and bodies. Flood lights, located as shown in one of the illustrations, illuminate all equipment under the car to facilitate inspection during night operation. Automatic windshield wipers, operated by air pressure, wipe rain or snow off the windows to assure good visibility under stormy conditions.

About 100 ft. in advance of this center inspection pit is a device actuated by any defective equipment hanging below standard clearance limits where it might strike the glass window. If this detector operates, a red lamp is lighted in the pit to warn the inspector to get out. A special alarm is also given at a control panel in the retarder foreman's office on the crest so that the foreman can use his radio and instruct enginemen to stop cars being pushed up the grade.

(Above) Pressure oiling journals just before the car reaches the crest of the grade

(Left) A string of cars passing the inspection station at the new U. P. yard at Pocatello

Railway officers examining the new center inspection pit (left) and one of the side pits (right) at Pocatello yard

Each of the side inspection pits is 9 ft. long by 8 ft. wide with a floor 4 ft. below the rail top and the nearer side 7 ft. 3 in. from the track center line. Concrete walls of the side pits serve as foundations for two sheet-metal inspection houses which extend vertically high enough to accommodate upper inspection rooms, 9 ft. long by 6 ft. wide, with floors 11 ft. above the rail top. The inspection houses are constructed of 3-in. by 3-in. angle iron welded and enclosed with sheet metal, the exterior dimensions being 22 ft. high by 6 ft. wide and 12 ft. long parallel with the rails. A concrete passageway 3 ft. wide by 7 ft. high extends through the fill, connecting all three inspection pits.

A short distance in advance of the inspection station is a position at which one man on each side of the cut of cars uses a Mac Donald pressure gun with 30-in. flexible nozzle to apply heated winter-grade car oil to the journals. This is an aid in causing the cars to accelerate quickly when going down the incline. Along the rails at this location are shallow sheet metal pans filled with waste to catch any oil drippings or excess oil.

In normal operation, cars are pushed past the inspection station at a speed of three to four miles an hour which permits defects to be detected much more quickly and in fact better than on standing inspection since each wheel makes one complete revolution in passing the side pits. A sloping mirror 9 ft. long by 24 in. wide, is placed against each rail directly in front of the lower side inspection pits and enables inspectors to see the underside of trucks and wheel flanges.

Car inspector in the side pit using mirror (indicated by arrow) to examine the underside of the wheel rim and truck side frame

When any of the five men on duty at this inspection station see a defect on a car they use talk-back loud speakers to announce the fact. The car foreman on the ground then marks the car and determines whether it must be switched to the repair track. If so he notifies the retarder foreman at the crest office who changes the switch list and informs retarder operators accordingly.

Parts examined for defects in the center inspection pit include spring planks, bolsters, brake beams, draft gears and safety bars. In the side inspection pits the following parts are examined: Truck sides (side and bottom), brake beams, wheels, car floors (underneath), lower side of car couplers. Inspectors in the two upper stations look for defects in the roof and running boards, safety appliances, side defects including doors, drop doors of empty gondola cars and shifted loads on open-top cars.

Passenger-Car Terminal Attention—Interior*

By E. E. Packard†

It is the aim of every railroad at its originating terminal to service its passenger trains before spotting them at the station to receive passengers in such a manner that by cleanliness and the attractiveness of both color and design of the equipment the traveling public will immediately, upon coming onto the depot platform, be most favorably impressed. First impressions are lasting impressions and therefore if the cars and engine are thoroughly cleaned and nicely painted, inside and out, one is naturally inclined to feel that his comfort and pleasure have been given every consideration. As a result the groundwork is laid for new friends and resultant additional business. Service and maintenance, then, are very important features of the car department and, considering the maze of new mechanical devices with which the present-day streamline passenger car is appointed, it becomes a big problem and offers a very interesting topic for discussion.

(*Continued on page 92*)

* Presented at the August 14 meeting of the Pacific Railway Club.
† District master car repair, Southern Pacific, Los Angeles, Calif.

I. C. Builds Five Aluminum Hopper Cars

The latest experiment in equipment weight reduction which the Illinois Central has launched comprises five aluminum-and-steel hopper cars built in its McComb, Miss., shops and weighing only as much as four equivalent steel cars of earlier conventional design. It was in these same shops that the railroad some months ago assembled its first experimental aluminum refrigerator car, which is now in process of being tested.

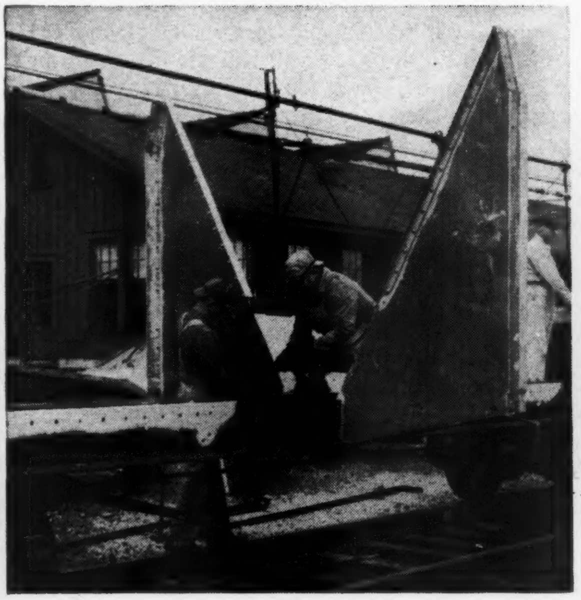
Completed just in time for the railroad's Christmas, the five new 50-ton hopper cars present a silver-like finish, with black trim and lettering, as they prepare to take the road with a combined saving in weight equal to the entire empty weight of an all-steel car. On a loaded basis, the saving in weight per car will equal about one-tenth of the pay load such a car can carry.

The light weight of the experimental car is about 37,400 lb. as compared with 47,300 lb. for an empty all-steel car of similar capacity. This is equivalent to a weight saving of 21 per cent or 9,900 lb. per car, or

Above: Riveting aluminum hopper assembly—Below left: Riveting aluminum crossridge gussets

Approximate Comparable Weights of Aluminum and Steel Parts Used in I. C. Hopper Cars

Description of material	Alcoa alloy used	Number of pieces per car	Weight per piece, aluminum, lb.	Weight per piece, steel, lb.	Weight saved per piece, lb.
Outside hopper sheet	61S-T6	4	70	208	138
Inside hopper sheet	61S-T6	4	43	125	82
Crossbearer gusset	61S-T6	2	106	304	198
Crossbearer sheet	61S-T4	2	215	635	420
End floor plates	61S-T4	2	276	703	427
Side floor plates	61S-T4	4	143	438	295
Side-stake pressing at bolster	61S-T6	4	22	63	41
Side-stake pressing, intermediate	61S-T6	4	28	88	60
Side-stake extension	61S-T6	14	5	13	8
Side-sheet splice-plate	61S-T4	8	16	45	29
Longitudinal hood sheet	61S-T4	2	87	246	159
End sheets	61S-T6	2	92	258	166
Side sheet reinforcement at bolster	61S-T4	4	8	23	15
Side sheet reinforcement and splice filler at bolster	61S-T6	4	1	2	1
Splice plate filler at bolster	61S-T6	4	½	1	½
Side stakes	61S-T6	8	16	42	26
Crossbearer and side connection	61S-T6	2	16	42	26
Side sheets	61S-T6	6	220	615	395
Side hopper sheet reinforcement	61S-T4	4	2	5	3
Center floor plate	61S-T4	2	20	65	45
Door closing angles	61S-T4	2	18	53	35
Door closing angle gusset	61S-T4	4	2	4	2
Door closing angle and side sheet tie	61S-T4	4	1	3	2
Crossbearer stiffener	61S-T6	2	11	30	19
Drop door with door hinge straps attached	61S-T6	4	54	147	93
Side sheets at end	61S-T4	4	67	185	118
Rivets	53S-T61	1710	158 (per car)	427 (per car)	269 (per car)



Above: Applying aluminum hopper assembly—Left: Applying aluminum crossridge gussets

approximately a million pounds, on a 100-car train. The railroad points out, however, that such trains and calculations are hypothetical; it has only five experimental cars which have yet to prove their ability under traffic.

In general, only the framework, running gear and safety appliances of the new cars are of steel, much of it reclaimed from old cars of the 66000-66698 series, a two-hopper, four-door design. The new cars are built in the same style, aluminum alloy taking the place of the side and end sheets and all the body parts except the upper edging. Even the reinforcing side stakes are of aluminum. Body parts are fabricated from quarter-inch aluminum sheets approximately 7 ft. by 8 ft. in size, each of which weighed 220 lb. as compared with 615 lb. for a similar sheet of car-quality steel.

Many of the aluminum car parts were formed hot in the railroad company shops, using steel dies and a generous supply of mutton tallow on both dies and sheets. In this case subsequent heat treatment was required to restore the physical properties of the metal. The balance of the aluminum parts were sheared or pressed cold. Hopper doors were supplied by the Standard Railway Equipment Company. The trucks are Dahlman type, equipped with Cardwell-Westinghouse snubbers and 33-in. cast-iron wheels.

Riveting end assembly of aluminum hoppers

Left: Driving rivets in door assembly for aluminum hoppers—Right: Reaming rivet holes in door assembly for aluminum hopper cars

Floor and crossridge gussets assembled on aluminum hopper cars

Various types of alloys of suitable hardnesses are used for different parts of the cars. Aluminum rivets predominate throughout, being used everywhere except where steel is joined to steel. Aluminum rivets not only hold the aluminum parts together but also serve in the places where aluminum is joined to steel. At these joints the steel is coated with a zinc-chromate primer and Alumilastic is applied between all laps and joints. Special temperature control in electric rivet heaters was required for heating the aluminum rivets.

The new cars have an inside length of 34 ft. 9 in. and a width of 10 ft. 1 in. They have been numbered 66700 to 66704, inclusive, and are being tested in coal service between Kentucky mines and Memphis, Tenn., where their performance can be closely watched.

Passenger-Car Terminal Attention—Interior

(*Continued from page 89*)

When a train arrives at the coach yard for servicing, it must be remembered there is a limited amount of time to work through, test and inspect all of the mechanical appurtenances and clean the cars thoroughly inside and out and still have the train ready and placed at the depot in plenty of time prior to the time for receiving passengers.

As we all like to have our homes and surroundings neat and clean, so do we want our passenger equipment, which we realize becomes a passenger's home for the duration of his journey. When he steps into the vestibule of his assigned car it should present an appearance of cleanliness, free from marks made by previous loading of baggage, or dirt and dust from the former trip. All vestibule door and other hardware should be polished and free from tarnish or rust, and in general it should present an inviting appearance.

Skilled Craftsmen Required

On arrival at the yards our trains are immediately set upon by all crafts, each man to his own separate assignment. There are the coach carpenters, electricians, pipefitters, tinners, upholsterers, painters, coach cleaners and the laborers who do the icing and watering of the trains.

In the order named, the coach carpenter makes a thorough inspection of each car, tries all of the doors, inspects the hinges and locks and other hardware, inspects every seat and tries the mechanism to see that there are no broken castings and that they can be easily operated by the passengers who are not always familiar with their mechanism. He replaces any loose or missing screws or bolts throughout the interior of the car, in the window frames and cappings, wall panels, etc., and makes repairs to any defective equipment which he may encounter.

The electricians' group is divided into two classes, service and repair. Generally a certain number of cars are assigned to a certain group of electricians and it is their duty to test all of the electrical devices throughout the cars. This includes air conditioning and heating, testing of electric luggage elevators, electric water coolers, fluorescent lights, all fans and motors, public address systems, radios, electric juicers and dishwashers in the dining-car kitchens and, of course, any defects which are found during the test have to be repaired and placed in serviceable condition before the train departs from the yard.

It can readily be seen that the electrical department has become a very important division of the car department, as all of the items which I have mentioned consist of intricate devices which in most cases are quite delicate and are easily thrown out of adjustment or get out of order; therefore, on present-day equipment technically trained and skilled mechanics are required to service and keep this equipment in repair.

Pipefitter's Work

The pipefitters are required to check all plumbing fixtures in their assigned cars, repair any leaky pipes, defective toilets, wash basins, dental bowls, etc., and install any water backs or sides in the dining car ranges. They repair and keep serviceable all tanks, underneath or overhead, check the hot- and cold-water system and repair any defective mixing valves or floor-heat valves; keep proper pressure on the pressure water tank, and see that all pipes in the dining-car steam tables are in good repair. As all of the heating and cooling systems on present-day equipment work automatically and are thermostatically controlled, the pipefitters, in conjunction with the electricians, are kept very busy seeing that all of the automatic devices are responding properly as well as steam admission valves, solenoid valves, pressure reducing valves, motorized valves, steam-heat regulators, flow limit valves and numerous other devices are checked and functioning properly. Any one of the items named may be a contributing factor to a failed air-conditioning or heating unit.

The tinners, whose craft is closely connected with the pipefitters, keep all air filters in good repair, service and repair dining-car coffee urns, make any necessary repairs in kitchens, around steam tables, sinks, ice-cream cabinets, metal cupboards and chill boxes, repair certain air-conditioning parts, overhead drain pans or steam-ejector air-conditioning equipment, and many and various other jobs along this line which arise daily. This department is responsible for removing and cleaning filters on all cars coming to the yards, and at the present time we are cleaning an average of 300 filters daily. In this cleaning process these filters are removed from the cars, hauled in specially made wagons to the filter cleaning room, dipped in hot cleaning solution for a certain period of time, then removed and blown out with air,

after which they are placed in ovens to dry and then sprayed with a very light oil before being replaced in the cars. This division of the car department also has grown very rapidly and it is necessary to expand the facilities continually in keeping with the expansion of the work that is now required on our present-day cars.

Upholstery and Painting

Upholsterers are employed to look after the upkeep and repair on all seats, carpets, drapes, portieres, window curtains and their fixtures, rubber tiling, leather booths and tables in tavern cars, dining-car chair covers, lounge and parlor-car settees and sectional seats and other work of this nature. These items are continually in need of repair or replacement. In the case of draperies, portieres, etc., they have to be removed at regular intervals and thoroughly cleaned, and for this reason for all of our streamline equipment we carry spare sets of these items, including carpets for cars which have carpeted floors.

Painters are required to see that all interiors are kept properly touched up. Marks that cannot be cleaned by regular cleaning methods must be sanded down and retouched. Walls around wash basins in the wash rooms become spotted and very often have to be redone to keep them in presentable condition. The new equipment is finished inside in light pastel shades so it is necessary for all colors to be carefully matched. Therefore there is always a large force of painters to keep these cars up at all times. Over the luggage racks, where the placing of bags constantly marks the ceiling panels, it is quite often necessary to re-do these panels. This is also true of the vestibules, where bags are very often piled up and paint work becomes marked from them.

The coach cleaners have the larger job; at least it is most important that the cars receive a thorough interior cleaning. Ceilings and walls have to be washed. Overhead baggage racks must be washed, windows cleaned well, cars thoroughly dusted, all seats vacuumed; floors, if rubber tiled or linoleum covered, are hand scrubbed and waxed at the end of each trip. Seat bases are washed. In the wash room, lavatories and toilets must be scoured and thoroughly cleaned. Chrome or nickel-plated mouldings or fixtures must be polished. Vestibule ceilings and walls are washed down and the platforms are mopped. Seats must have stains, grease marks, imbedded gum, etc., thoroughly removed. Carpets must be vacuumed or lightly shampooed as required and spots and stains removed. Drapes and portieres, if not due for removal and periodical cleaning, must have spots or stains removed from them.

Personnel Problems

While we always strive for a high standard of maintenance on our equipment, it must be remembered that we encounter many difficulties, such as absenteeism, which requires us to work short-handed in many instances. Other emergencies which arise almost daily require our yard supervisors to use all of their ingenuity to effect the necessary work and repairs in order to turn the trains out on time.

I have given you a brief resume of the work that is required to keep present-day passenger equipment on the road. The car department has grown with such rapid strides that it is somewhat difficult to comprehend fully the vast change which has taken place. A department which not so many years ago employed possibly one or two electricians in addition to its regular carmen, today has expanded to one requiring a very large crew of technically trained and skilled mechanics.

In view of the opportunities that are afforded by the railroads today, I am wondering if there are not quite a few mechanically minded young men who are overlooking these opportunities and possibly laboring under the dream of getting some glamourous, high-salaried position, which, of course, seldom materializes, who in a few years may be regretful of the fact that they did not settle down and avail themselves of an apprenticeship training such as we have to offer.

Railroad work is interesting and most fascinating and I can say in all sincerity to young men of today, who are ready for good, stabilized employment, that an apprenticeship training in one of the many departments of the railroads will put them on solid ground for the future. If you will look at the average railroad man who has been in the business over a period of years, you will find in the majority of cases a man who owns his own home, drives an automobile, provides good schooling and environment for his children. After everything is summed up, that sort of security is about all there is to be desired in life.

Passenger-Car Terminal Attention–Exterior*

By R. V. Ketring†

Few people realize what it means to service and prepare a passenger train (especially the new equipment known as streamline trains) for a comfortable and safe journey across the country. I will endeavor to give a brief resume of what is involved in preparing the outside and running gear.

Passenger trains, after arriving at the Union Depot, Los Angeles, Cal., are switched to our coach yard, where the equipment is placed on a designated track for a complete and thorough inspection of such parts as couplers, draft gears, wheels, trucks and all underneath parts. The train is then switched to another track in the coach yard, where it is coupled to a steam line which is used in testing out the steam heat and air-conditioning equipment; coupled to the compressed-air line for testing the air-brake equipment, and men are assigned, such as steam-heat men, air-brake men, to test, inspect and make necessary repairs to the above equipment. At the same time these inspections and tests are being made, we have brake-shoe men or coach-truck repairmen changing brake shoes and doing the other light work. One of our big

* Paper presented at the August 14 meeting of the Pacific Railway Club.
† General car foreman, A. T. & S. F., Los Angeles, Calif.

problems on passenger cars is the changing of brake shoes, as some of our trains we start out with all new shoes; others we change when worn to different thicknesses such as 1 in., 1¼ in., 1⅜ in., depending on the service. During the month of July we renewed 18,041 brake shoes on passenger cars equipped with the conventional type brake, and 156 on the Budd disc brake.

One of the most important problems is inspection and care of roller bearings, journal bearings and packing, as hot boxes and bearing failures cause serious delays en route and are sometimes responsible for serious accidents. In the inspection of cars equipped with roller-bearing wheels, one of the duties of the inspector or oiler is to remove the plug in the front of the box and use a magnetic feeler for parts of metals and discolored oil. If this condition is found, then the wheels have to be removed and bearings serviced. If no indication of the above is found, then add oil as required. On cars equipped with the old style journal boxes, brasses, wedges and packing, it is necessary to raise the journal-box lid, inspect the above and then properly lubricate the packing.

In outside cleaning and scrubbing of passenger cars, we use a cleaning compound mixed with water, which is brushed onto the cars, then the cars are scrubbed with brushes and rinsed off with water, which leaves a clean, bright surface and a very presentable appearance.

In the past the trucks of our passenger cars always presented an unsightly appearance until we started cleaning them by the following method: First, we spray the same solution on them that is used on the body of the car. Then we use a Sellers jet, which mixes steam and water, making hot water under pressure. This is used to wash the dirt and solution off the trucks. Then the trucks are painted, and make a very presentable appearance. This applies only on our streamlined trains.

Then comes the final operation, which is of great importance. This is the final testing of the air brakes. In this test, a set of the brakes is made, then train lines leakage is taken, and if any found, necessary repairs have to be made to correct; all piston travel is measured to see if of proper length. The Decelostats and Rolokrons, which are anti-wheel-sliding devices, are checked and inspected. Then the brakes are released and the piston travel is all adjusted to a standard length.

The train is then turned over to the yard forces for movement to Union Depot, where it is set ready for the passengers to entrain for a journey across the country.

Portable Car Washer

The portable, or mobile, car-washing machine shown in the illustration was designed, built and patented by W. H. Gould, general foreman car department, Union Pacific, Pocatello, Idaho, and successfully used for cleaning windows while passenger trains are standing in the Pocatello station. Operated by one man, the machine is said to do a satisfactory washing job fast enough to work down one side of the 12-car streamliner, "City of Portland," and return on the other side in eight minutes, using 30 gal. of clear water.

The general construction of the machine will be apparent from the illustration. It consists of a Buda Chore Boy three-wheel power unit with a trailer tank holding 250 gal. of water. Mounted on the power unit is a steel tripod supporting a shrouded rotating brush which revolves at 1,000 r. p. m. counter-clockwise and is driven by V-belts, drive-shaft and pulleys from a Kohler 5-hp. gasoline engine mounted on the base of the power unit. The brush runs smoothly and is held with light pressure against the car side by springs and a hand lever.

By means of a small power-driven pump, water is taken from the trailer tank and delivered under pressure to a short section of perforated pipe in the brush shroud which directs small streams of water against the car windows. The revolving brush then loosens all dirt which is washed off with the flow of water. Using hot water, this window washer is said to operate satisfactorily at a minimum temperature of 20 deg. F.

Mobile passenger-car window washer used on the Union Pacific at Pocatello, Idaho

ELECTRICAL SECTION

Diesel-Electric

Speed-Responsive Controls*

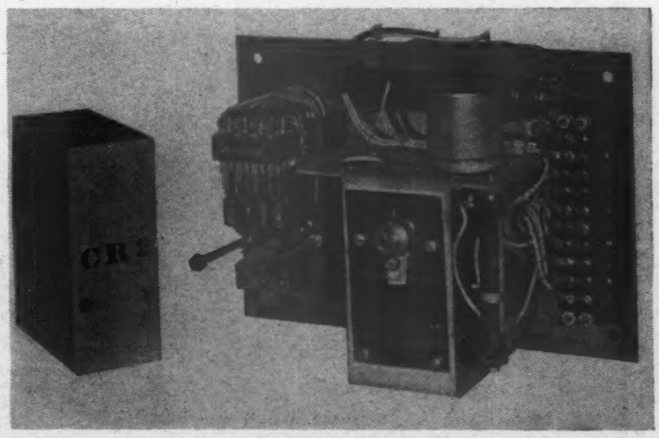
By A. V. Johansson†

Frequency-controlled relays for motor transition now have a year's performance record showing stability of settings and reliability of operation

A CONTROL system is now being used on a number of road passenger Diesel-electric locomotives which initiates changes in motor connections at certain train speeds. Most large Diesel-electric locomotives employed in freight and passenger service on domestic railroads have two motor combinations, each with one or more steps of motor field shunting. They provide full utilization of engine horsepower over a wide range of train speed while meeting the requirement that the electric equipment be as light in weight as possible, consistent with good performance. High schedule speeds require that within the limits of adhesion, available engine horsepower be delivered to the wheels at all times during acceleration. To accomplish this it is necessary to change to weak field and to new motor connections at the proper times during the cycle of acceleration. This has been done on freight locomotives by manual selection, with the operator reading a speed indicator and changing his connections at certain train speeds. In passenger service, with its higher acceleration rates and greater schedule speeds, and therefore greater dependence on maintenance of full utilization of engine horsepower during acceleration, it has been found desirable to provide automatic selection of motor connections to relieve the operator of this responsibility and to maintain more uniform acceleration of the train than would be had by manual selection.

Automatic Transmission

Several means of automatic selection have been used, the simplest using a voltage relay which operates when the generator voltage reaches a certain point. Another method uses a relay which operates on generator voltage and current, and this method is superior to the first in that it will operate at any engine speed rather than at top speed only. These methods have been used on older locomotives which did not have field shunting in both motor combinations. When one or more steps of field shunting in each of two motor combinations are required, the number of such relays becomes large, the circuits are rather involved, and transients during switching



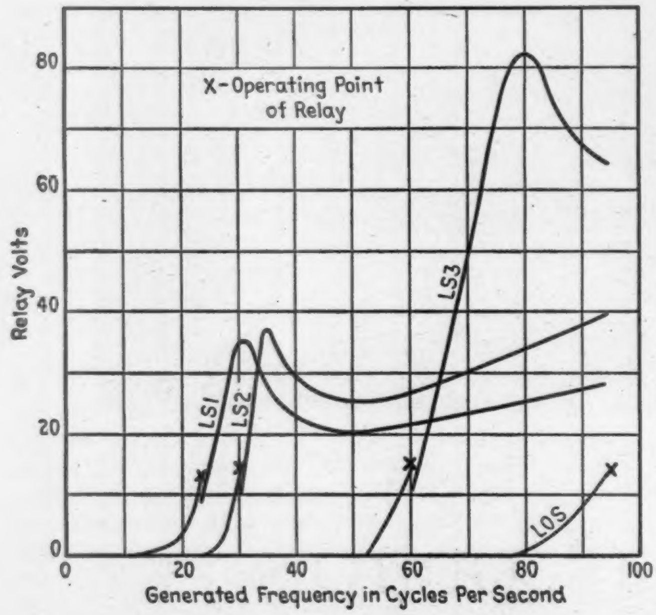
Speed-sensitive relay panel (front view)

* Abstract of a paper presented at the Winter Meeting of the American Institute of Electrical Engineers, held in Pittsburgh, Pa., January 26-30, 1948.

† Control Division, General Electric Company, Erie, Pa.

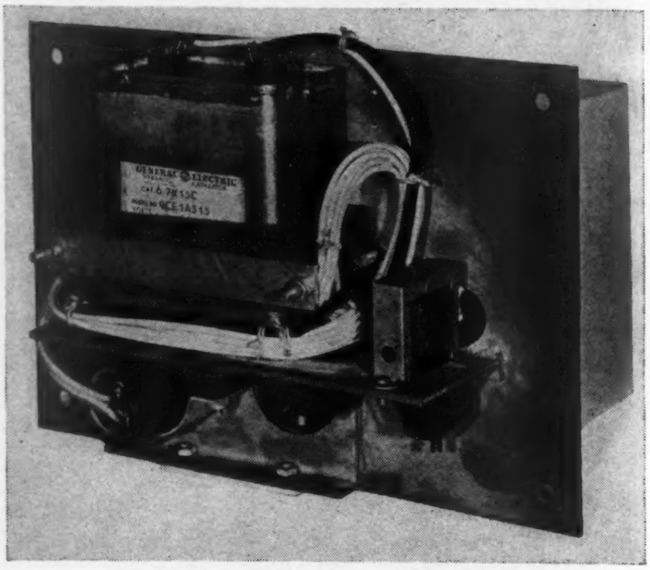
present a difficult problem. This is especially true when automatic backward transition and unshunting are required.

A new means of automatically selecting motor connections in several steps, either forward with increasing speed, or backward as the locomotive decelerates during operation up a heavy grade, has been devised



Curves showing relay coil voltages plotted against frequency of generator output

and applied to new Diesel-electric passenger locomotives, electric equipment for which is built by the General Electric Company. This method utilizes a group of relays energized through the medium of a tuned circuit by an a. c. generator mounted on a locomotive axle. Because of the tuned hircuit, the voltage across the relay coil increases very rapidly as the speed at which



Rear view of a speed-sensitive relay panel

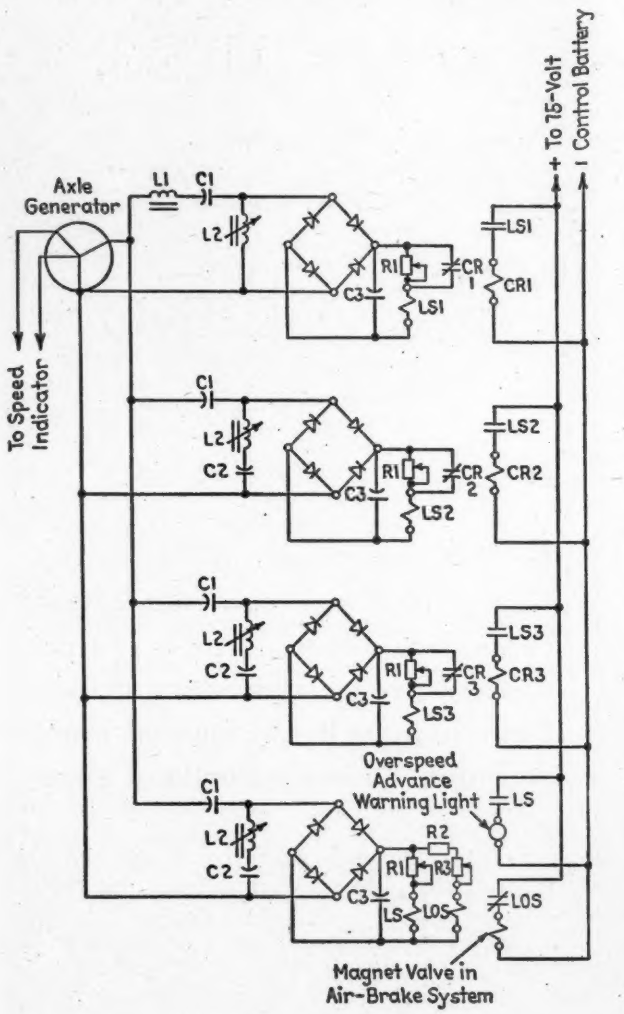
the relay is to operate is approached, providing an inherently accurate and stable speed setting of the relay and a drop-out speed close to the pick-up value.

Variable Frequency Generator and Relays

The generator used has a 14-pole permanent magnet rotor, the output being taken from the stator coils, which are three-phase, Y-connected, with the neutral brought out. The generator is bolted to a special cover on the antifriction journal box on the end of one of the locomotive axles, replacing the journal box cover. The rotor is driven by the locomotive axle through a double-end splined drive shaft. This shaft is so designed that it may be disengaged from the axle, pulled through the rotor, and engaged with a motor-driven calibrating mechanism in order that the generator may be conveniently operated for relay calibration without removing it from the locomotive.

An axle generator mounted on a locomotive

The generator energizes the speed relays and, in addition, the locomotive speed indicator. Each speed relay



Schematic diagram of relay circuits

panel consists of one or more reactors, suitable capacitors, a full-wave rectifier, a small hermtically-sealed sensitive relay, and a multiple-contact control relay. The control relay, energized by 75-volt d. c. locomotive control power, fed through the contacts of the sensitive relay, controls field shunting contactors or starts the transition sequence leading to a new motor combination, as the case may be. In addition to the three relay panels required for the two connections of field shunting and the transition, a fourth relay panel may be used to provide a warning of impending locomotive overspeed and to shut off power and apply air brakes in the event of actual locomotive overspeed.

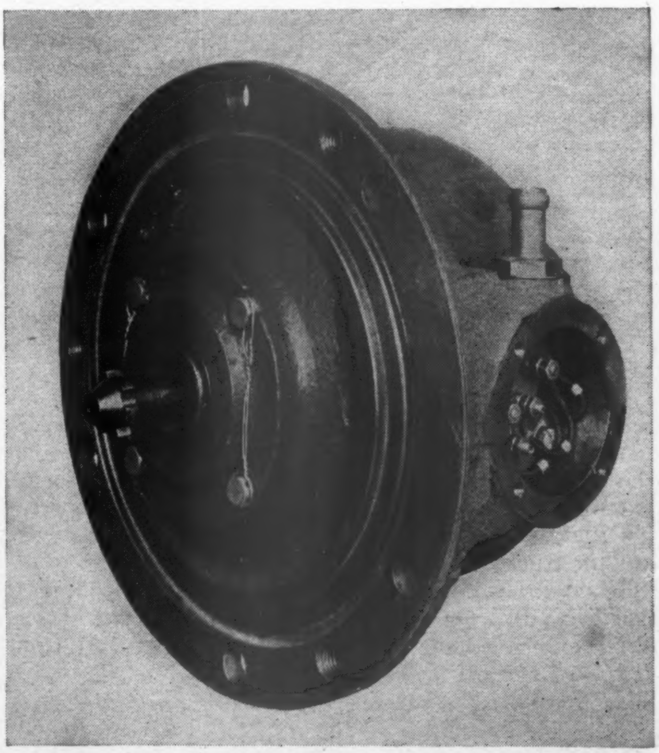
Circuits

As will be noted from the circuit diagram, the speed indicator is connected between one phase and the neutral of the generator and is, therefore, not materially affected by the loading presented by the speed relays. The speed relays are connected across two phases of the generator, and operate from the algebraic sum of the voltages produced in each of these phases.

The speed relay circuits are shown from top to bottom in the order in which they operate, with the one operating at the lowest speed shown at the top. The circuits are alike between the generator and full wave rectifier except for the circuit operating relay LS1. Referring to the curve for this circuit, it will be noted that resonance occurs at 31 cycles per second. Reactor L-1 in series with the load is used to hold the output voltage down while above the resonant frequency, as the generator voltage is proportional to speed, and the relay coil current would otherwise rise above a safe continuous value. Since the curves for relays LS1 and LS2 are similar in shape and close together in frequency, though the circuits differ, it should be pointed out that each circuit is also used on locomotives requiring other settings, and while the ranges of possible settings for each circuit and set of components overlap slightly, the circuit for LS2 does not cover enough range to meet the requirements for LS1.

Performance

As shown by the curves, the relays pick up at a rather low voltage compared with the maximum reached, and this assures the relays' holding in when the droop in voltage occurs at speeds above the resonant point. It will be noted that the relays pick up and drop out on a very steep part of the voltage curve, providing an inherently stable setting and a dropout value close to the pickup value. Where required, the dropout value is raised even closer to the pickup value by means of the insertion of resistance in the coil circuit of the sensitive relay by the control relay operated by the speed relay in each case.



Variable frequency axle generator for mounting on the end of an axle

The control relay has a separate cover to prevent the entrance of dirt and the sensitive relay is enclosed in a hermetically sealed can. Since the remainder of the equipment is static in type, very little maintenance is required.

The first locomotive to be equipped with speed sensitive relays went into service during the last year, and many others are now in use. Results have been very gratifying both as to stability of settings and reliability of operation.

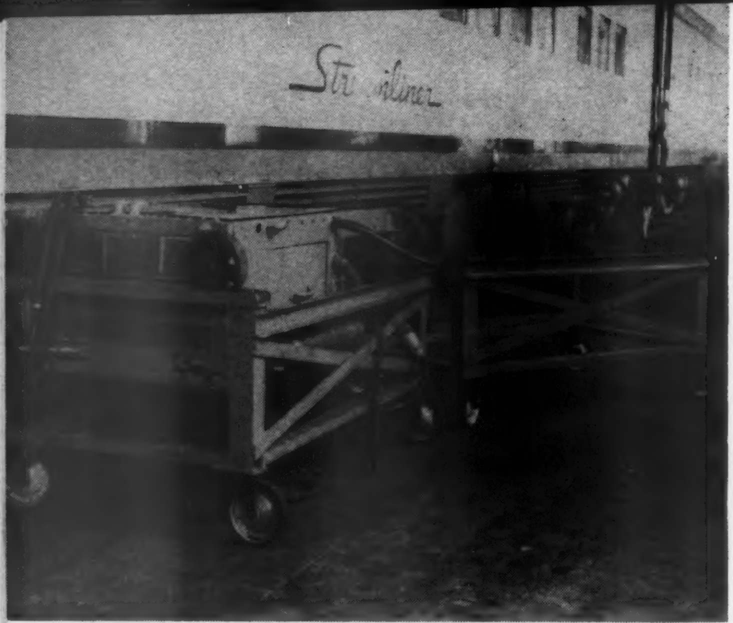


Fig. 1—Rolling stands used to remove and reapply Waukesha air conditioning units to passenger cars

Re-equips A. C. Shop at Portland

Rolling positioners and lifting stands, plus a dynamometer, test racks, and adequate tools permit orderly progressive maintenance and eliminate heavy manual work at Union Pacific's Portland shop

THE Union Pacific's air conditioning shop at Portland, Ore., has been overhauled, replanned and re-equipped so that it now stands as an example of orderly and efficient progressive maintenance. The shop is equipped for the overhaul and repair of all types of air conditioning. It is designed to handle three Waukesha units per day, along with a variety of others including Safety-Carrier steam-ejector equipment, and Pullman, York, General Electric, Safety, and Airtemp axle-powered equipment.

Equipment units to be overhauled are brought in at one end of the shop, are carried through progressive stages along one side and then back up the opposite side. Work is greatly facilitated by portable positioners and stands for every type of equipment.

Waukesha engine-compressor or engine-generator units are removed intact from the train. This is accomplished with the aid of portable stands (Fig. 1) which may be rolled to the car. They have tracks which match the extension rails of the roll-out carriages on the car. During removal, the stands are pinned to the extension rails and the unit is rolled out onto the portable stand. The units are picked up from the stand by a crane truck and transported to the shop.

Upon arrival at the shop, the unit is placed in a portable positioner (Fig. 2). The first operation consists of air cleaning the unit with compressed air from the shop lines. An electrician then strips the unit of electric apparatus. He is followed by a pipe fitter, and then a machinist.

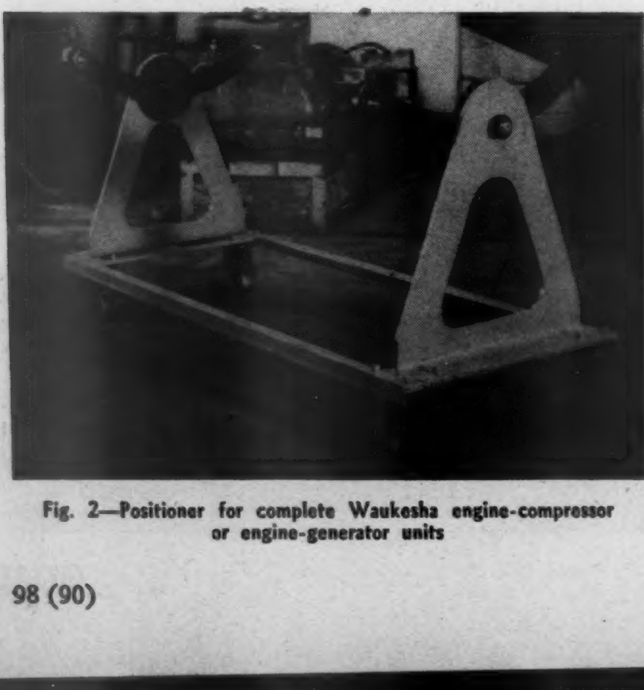


Fig. 2—Positioner for complete Waukesha engine-compressor or engine-generator units

The unit is then steam cleaned. A portable lifting frame, shown in Fig. 3, made of welded extra-heavy 2½-in. pipe and mounted on four large casters provides a means for removing the engine, the compressor or the generator.

A chain block hung from the upper member of the portable frame is used to lift the part out of its frame. The air-conditioning unit frame is then painted and the engine-compressor assembly is moved while suspended from the portable frame to a second positioner, made for the engine (Fig. 4). It is also portable so it may be placed in any location, and the engine to any position for making the work convenient. The picture of the engine positioner was taken before its wheels were applied.

The engine is first tested for compression. While it is cranked by hand, measurements are taken by a compression gauge screwed into each spark plug hole. The head is removed, and pistons and cylinders are examined for wear with a feeler gauge. If the compression is good, it may not be necessary to remove the pistons. Valves are ground, or faced if necessary, and if conditions require, new valve inserts are applied. Valve tappets are examined and cleaned and all carbon is removed from the engine. The crank case pan is removed and bearings are inspected. If they are in satisfactory condition, the engine is reassembled. (The above is work done at each monthly inspection. Every four months engines are torn down and given a complete overhaul regardless of conditions found on inspection.)

The water pump is disassembled and inspected, new parts being used to replace old ones, as necessary. The magneto is also removed and overhauled if necessary.

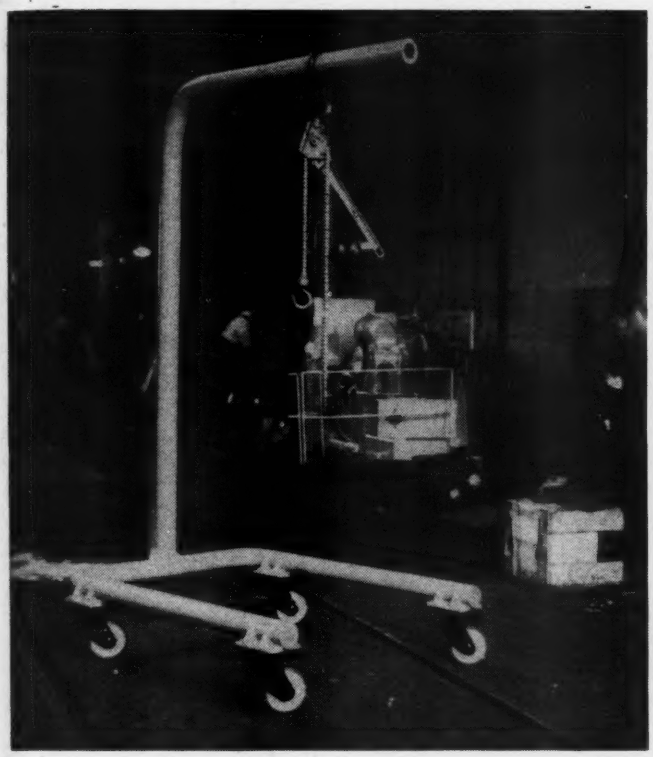


Fig. 3—Portable lifting frame for handling engines, generators, compressors, etc.

Generators and Compressors

When generators are removed from the unit, they are placed in a rolling positioner as shown in Fig. 5. The work done consists of removing the armature and, if necessary, turning and undercutting the commutator and replacing the bearings. Armature windings and field coils are tested and inspected. New brushes are applied, if needed, and the machine is reassembled. The generator is not tested until it is reassembled in the unit.

Compressors are removed, disassembled, inspected and reconditioned. On rotary types, this consists of measuring end and lateral clearances with a micrometer and making adjustments if necessary. New rotor blades and new bearings are applied if needed. Compressor cylinders are also renewed when necessary, after which the compressor is reassembled and tested.

Fig. 4—An engine positioner—The picture was taken before rollers were applied

The first test consists of driving the compressor on a shop-built test-stand (Figs. 6 and 7), which includes a driving motor and all the other parts of the freon system. The compressor is first run light to check for vibration and noise. It is then connected to the freon system of the test rack, and given another running test for performance, the equipment on the rack being made to simulate its performance as installed on a car. The compressor is again tested after assembly as a complete unit.

Reciprocating compressors are disassembled, and new valves, rings, pistons and bearings are applied if needed.

Fig. 5—Type of rolling positioner used for generators

The crankshaft and all bearings are measured and inspected. They are then reassembled, tested on the test stand (Figs. 6 and 7), and reapplied. Most of the reciprocating compressors are those for the mechanical and electro-mechanical air conditioning systems which derive their power from a car axle. Compressors and generators for this equipment are overhauled and tested with the same procedure used for the Waukesha equipment.

All Waukesha engine-generator sets are given a load test on a resistance load with the aid of the special test stand shown in Fig. 8.

Special Shop Equipment

Pullman speed controls for axle-powered, air conditioning drives are removed from the car when necessary. They are disassembled, inspected, repaired and tested on a special dynamometer.

The dynamometer is powered by a 15-hp. motor which is under the stand behind the handwheel, Fig. 9. The speed control to be tested is mounted on the upper deck of the dynamometer inside the wire screen. It is belt-connected to the driving motor with V-belts which are behind the operator. The motor drives the magnetic clutch of the speed control at 1,200 r. p. m.

The right hand end of the magnetic clutch under test is coupled to a second magnetic clutch which is a part

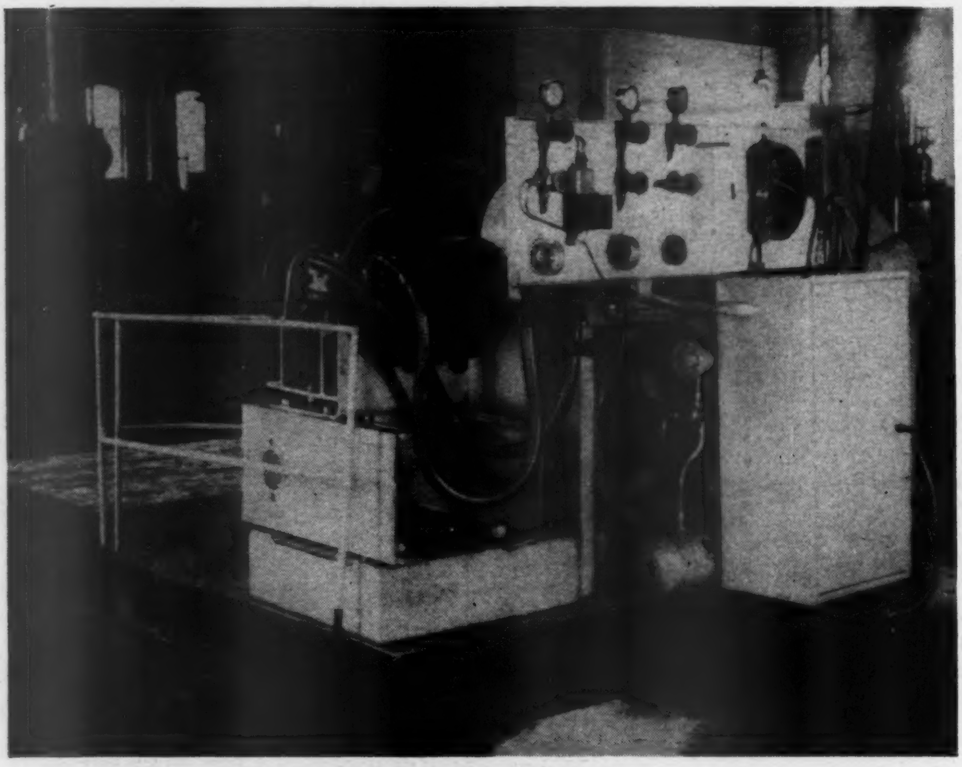


Fig. 6—Side of compressor stand showing gauge and switch panel and a rotary compressor in place

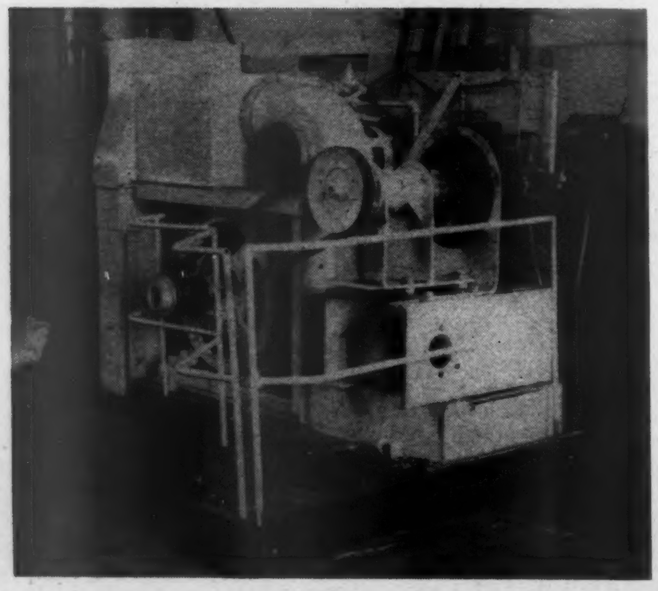


Fig. 7—Compressor test stand showing portion inside railings used to test axle drives

of the dynamometer. This second clutch is mounted on a torsion spring, the torque being shown on a graduated, slotted scale which may be seen in front of the clutch. Driven from the right end of the clutch is a speed recorder. This gives the operator both speed and torque, the product of which is horsepower.

Current for energizing the coils of the magnetic clutches is obtained from a 32-volt headlight generator which is also belt-driven from the motor. For purpose of test, the coils are magnetized and the torque and speed recorded. Normally, the speed is held at a fixed value so that the torque scale reads directly in hp.

The 15-hp. driving motor is also direct-connected to a 4-kw. car lighting generator which may be seen at the right on the lower deck of the dynamometer. This generator, which is excited by the headlight generator, is used for starting Waukesha engine generator sets.

The compressor and axle-drive test stand shown in Figs. 6 and 7, is powered by a 10-hp. variable-speed, d. c. motor. The stand is equipped with complete air conditioning equipment as used on a car including condenser coils, evaporator coils, blower fans, high and low pressure protection switch, steam heat coil, expansion valve, gauges, etc. The compressor to be tested is placed on the stand as shown. After being given a running test for vibration and noise, the compressor is connected to the air conditioning system by means of

Fig. 8—Engine-generator load test stand—The cable at the left supplies starting current from a motor-driven generator and the one at the right connects the engine-driven generator with the test stand

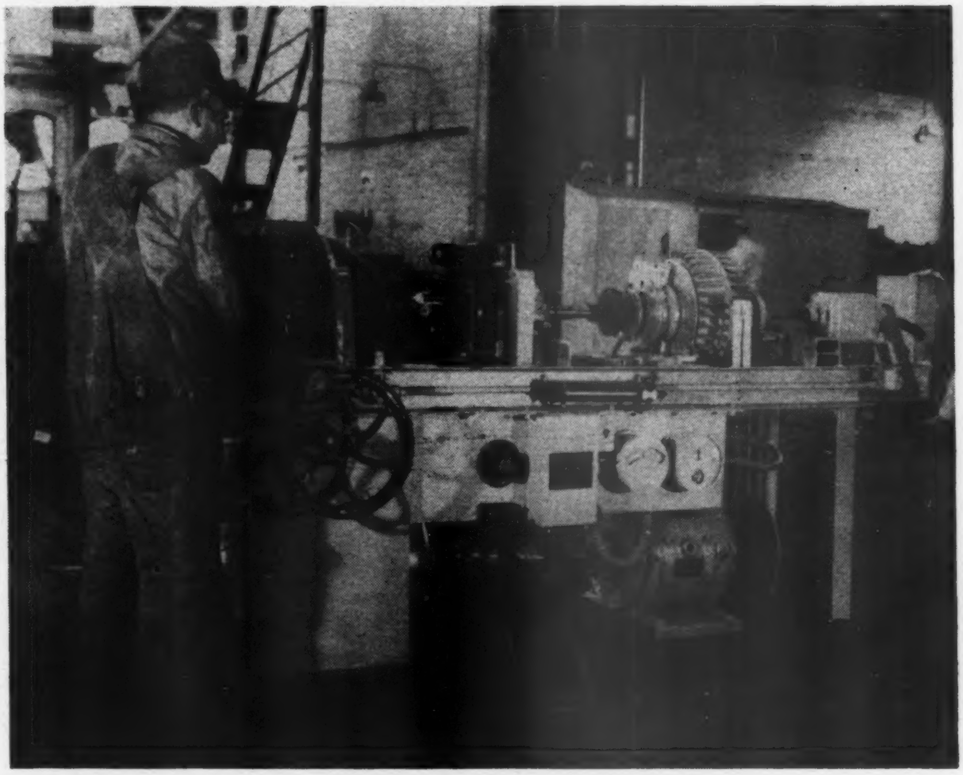


Fig. 9—Dynamometer used to test Pullman speed controls

flexible metal hoses and measurements are made to show that it is in perfect running condition.

All types of axle-drives may also be tested on the stand. They are placed inside the handrail as shown in the foreground of Fig. 7. They are clamped to the stand and belt-connected to the motor. After being checked for vibration and noise, they are given a four-hour run to show possible heating of bearings or gears.

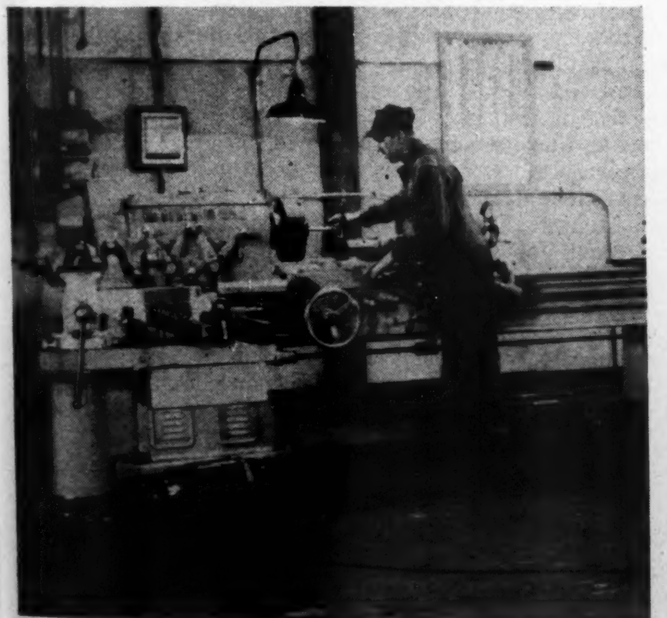


Fig. 10—A lathe is an important part of any electrical repair shop

The resistor test stand shown in Fig. 8, is used to load test Waukesha engine-generator units or Waukesha compressor-engine starter generators. It is also equipped to check the operation of the oil switch, heat switch, high and low pressure switches, vacuum switches, and also to check for grounds. The load on the generator can be varied either by load resistances controlled by the switches shown at the operator's left hand or by the generator field rheostat or both. The stand has on it all Waukesha electrical control except the time control.

The lathe shown in Fig. 10 is used for turning commutators, refinishing surfaces, making shop tools and a wide variety of other work. It is busy constantly. A drill press and grinder are also necessary tools.

When condenser fans are overhauled, they are placed on a test rack where they are run at speed by a 2-hp. motor belt-connected to the blower. If one of the bearings is noisy, it is difficult to determine which one it is. This has been made simple by the arrangement shown in Fig. 11. The plate on which the blower is mounted is fitted with two metal boxes, also mounted on the plate. One box is in line with each fan bearing. Each

Fig. 11—Test rack used to find noisy fan-motor bearings

Fig. 12—The work benches have ample tool storage space, and rolling stands for small parts avoid clutter

box is 4 in. deep, 6 in. wide and 10 in. high. They are made of ⅛-in. sheet iron and each is fitted with a hinged front door or cover. When a door is open, the sound of a noisy bearing in line with it is amplified, indicating which is the noisy bearing.

A test stand for steam-ejector equipment is also included in the shop facilities. This may be seen behind the bearing tester in Fig. 11.

Good work benches such as shown in Fig. 12 are an important part of the shop facilities. They have ample drawer and cabinet space for tools, a raised shelf on which to lay tools and small parts. At the left is a rolling, three-deck stand on which small parts are moved between the bench and the point at which a machine is being stripped or reassembled.

The shop is characterized by the large amount of portable facilities. This allows for extreme flexibility and orderly progressive overhaul of all types of air conditioning equipment. No manual lifting or moving of heavy parts is required. Another advantage of the arrangement is that it has completely avoided the need of having men interfere with each other's work. As the result of these factors the shop output has been considerably increased.

Load Tests Insure Road Performance

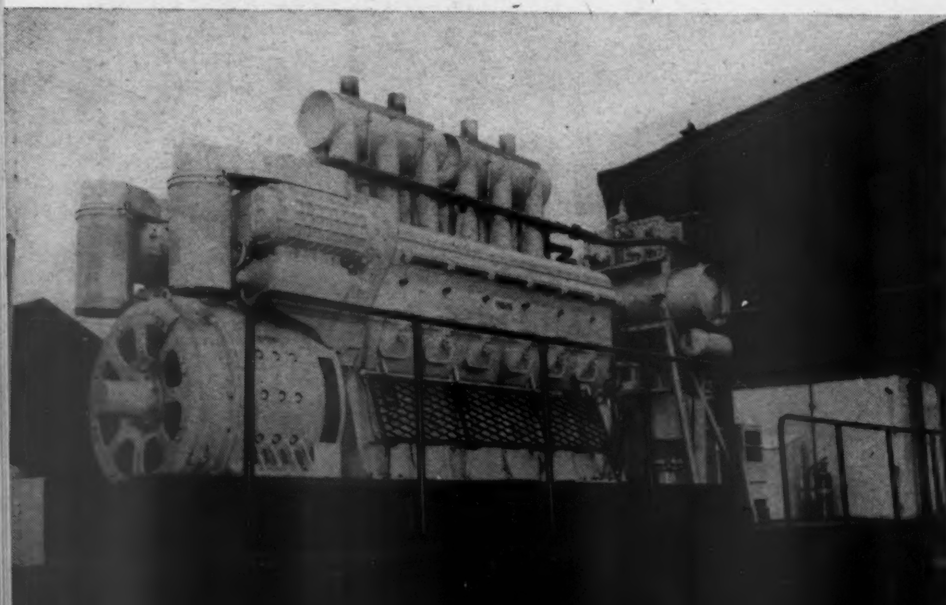
The Union Pacific makes a practice of load-testing all Diesel-locomotive engines, generators and traction motors, after they have been overhauled in its Omaha, Nebr., shops and before they are replaced in a locomotive. An engine-generator test stand was mounted on a flat car and the power generated during run-in tests on this stand is used for load testing motors. A box car, equipped with a motor stand, water-cooled prony brakes and the necessary meters and gauges, is used for testing the motors. This was described in the November, 1945 issue of *Railway Mechanical Engineer,* page 543.

The flat car on which engines and generators are tested is fitted with a bed on which to mount the engine and generator with fuel and water connections duplicating those on a locomotive. At one end of the car there is a 1,000-gal. fuel tank. In the place of a radiator there is a water connection to the shop water supply, a valve being used to regulate the flow and control engine temperature. The engine bed will accommodate the two types of 12-cylinder engines used on the Union Pacific, and plans have been made to extend the bed sufficiently to accommodate 16-cylinder engines. A standard locomotive battery is used for cranking the engine and for the operation of controls. It is charged through a receptacle on the car from standby power. The control has eight throttle positions as on a locomotive, and an E. M. D. load regulator. The load regulator holds a constant horsepower load for each throttle setting.

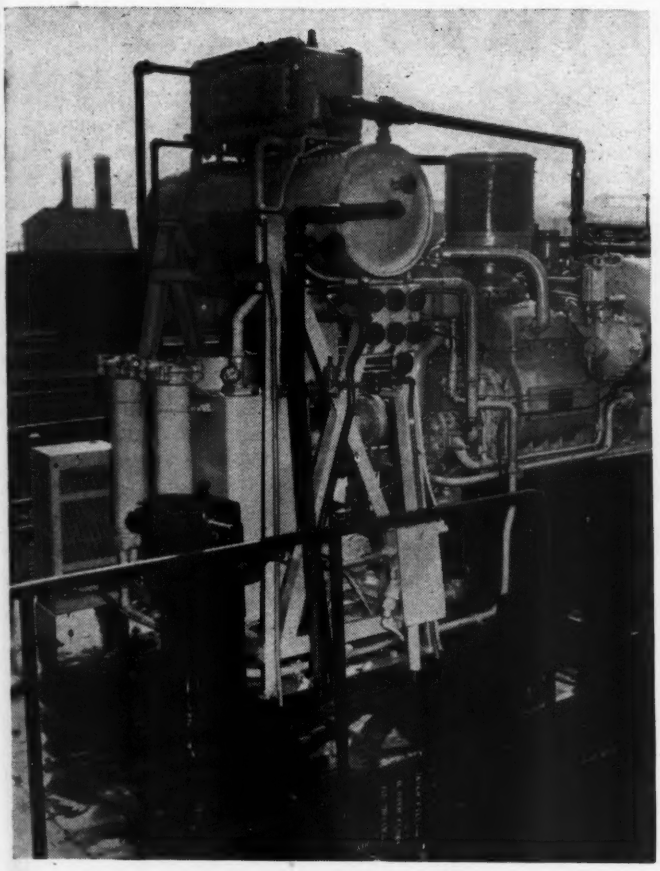
A full-load test is made on the engine and generator, a water-cooled rheostat being used for loading the generator. The engine and generator receive a four-hour full-load test, after which they are used on reduced load for testing traction motors.

When testing traction motors, the engine throttle is set at a position corresponding to full load on one motor, and a water-cooled brake is used to determine motor current and speed.

Motors which have been given a mileage overhaul are run for one hour at a speed corresponding to 40 m. p. h. with full-load current. For the second hour, they are run at a higher speed (90 m. p. h.) for passenger locomotive motors and at lower current and higher voltage corresponding to full-load horsepower. The bearings are checked to disclose any fault which may develop with vibration and operating temperatures. If



An engine and generator in position for testing



Engine control equipment on the test car duplicates that used on a locomotive

time permits, the complete assembly of motor, pinion, gear, motor support bearings, wheels, axle and axle bearings are tested as a unit and applied to the locomotive.

Rewound motors are run at full-load current at about 40 m. p. h. for four hours, after which they receive a high-speed test for from 30 min. to an hour. Following the load test, the motor is disassembled for general inspection of all parts and given a 1,500-volt dielectric test.

Electric Locomotives For the Virginian

The first of four electric locomotives for the Virginian was demonstrated and turned over to F. D. Beale, president of the railroad, by the General Electric Company, at Erie, Pa., on Thursday, January 14, 1948. These two-unit locomotives are rated 6,800 hp., and are called the most powerful continuously rated locomotives in the United States.

Other equipment being supplied by the company to provide faster and more efficient transportation of coal over the Virginian's mountainous 134 miles of electrified route includes a 10,000-kw. steam turbine-generator, now under construction by the G. E. Turbine and Gear Divisions at Schenectady, N. Y.

With a total overall length of 150 ft. 8 in. between knuckles, each locomotive is of the streamlined type. Fabricated throughout from structural-steel shapes and plates, the all-welded cab is divided into three compartments: the apparatus compartment, containing the motor-generator set, transformer, and auxiliary equipment; the operator's compartment, and the "nose" compartment containing miscellaneous equipment and accessories. The sub- and truck-frames are made of heavy steel castings.

First of its type to carry 1,000,000 lb. on the drivers, the locomotive can develop continuously a tractive force of 162,000 lb. at 15.75 m. p. h. On the basis of rating input to the traction generator for traction purposes, customary in rating Diesel-electric locomotives, this all-electric locomotive has a horsepower rating of 8,000.

The new design, incorporating the latest mechanical and electrical improvements and developments, will enable the G. E.-built locomotive to haul 10,000-ton coal trains at moderate speeds on heavy grades. With lighter freight behind, it will be able to maintain speeds up to 50 m. p. h.

The locomotives will draw power from the Virginian's 11,000-volt overhead line to operate the two five-unit motor-generator sets in the locomotive. Energy is supplied to the traction motors by two traction generators driven by a 4,000-hp. synchronous motor in each cab. The electric power is generated at Virginian Railway's power house at Narrows, Va., where bituminous coal is used as the primary fuel.

Monel Metal Subcooler Housings

The Southern Pacific has housed a number of its Waukesha air-conditioning subcoolers in Monel metal housings. They are identical in shape to the original sheet-steel housings except that they are three inches lower at the back than at the front. The single drain plug used in the original housings has been replaced with three 1½-in. plugs which are flush with the lower edge of the sloping bottom.

Monel metal does not rust and offers a smooth surface to which dirt does not cling. The pump intake is at the front and sludge settles at the back or lower edge where it is easily removed by flushing through the three drain holes. The pump does not pick up sludge and the impeller does not become clogged.

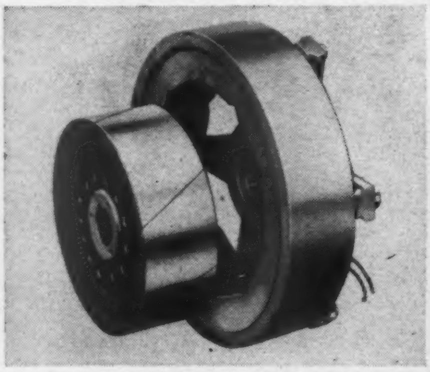
Clearance limits prevent the use of the new tanks on some cars, but on cars on which they have been applied, they have materially improved operation and have reduced the amount of servicing required.

One of the Monel metal subcooler housings made at the Sacramento shops of the Southern Pacific

NEW DEVICES

Magnetorque A. C. Crane Control

The Magnetorque alternating current crane control, recently developed by the Pawling & Harnischfeger Co., Milwaukee, Wis., is designed not only to eliminate the mechan-

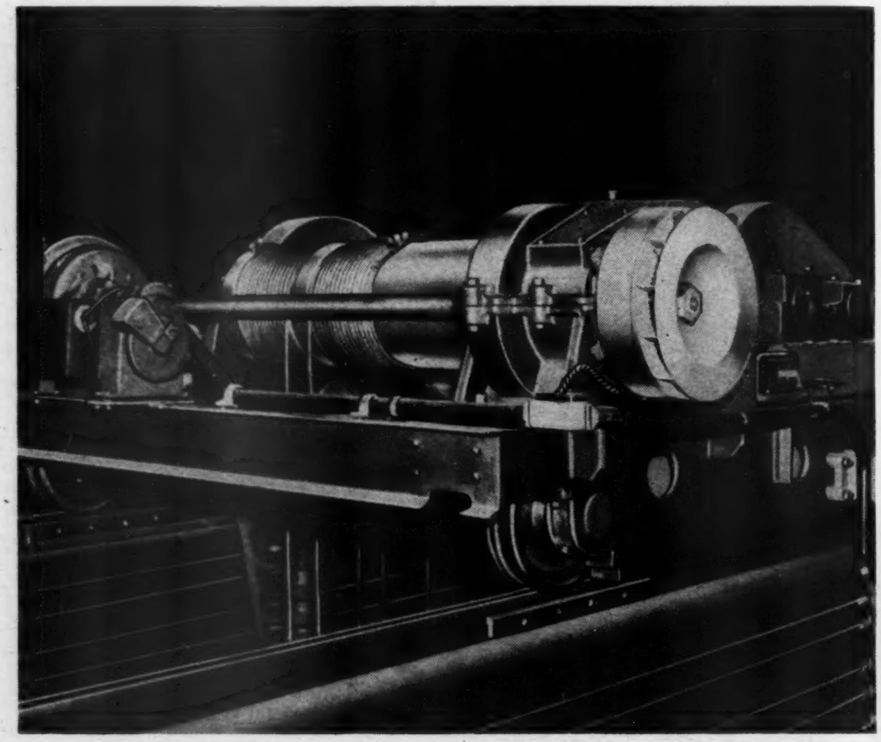


The P. & H. Magnetorque unit is simple

ical load brake on a.c. cranes, but to provide as favorable speed-load characteristics as direct current cranes, to handle heavy loads at slower speeds, and to combine flexible control at all speeds with simplicity of construction. The Magnetorque unit is readily applicable to overhead shop cranes and other types of cranes.

The Magnetorque brake is mounted on the motor pinion extension shaft and the hoist motor is directly connected to the hoist drum at all times. This always provides a positive drive between the motor and the hoistening unit. The unit consists of a stationary field ring which is bolted to the gear case and centered about the bearing capsule. The indestructible rotor requires no electrical connections and is similar to a rotor in a squirrel cage motor. Since the field poles are stationary and the rotor requires no electrical connections, there are no moving electrical parts. The braking torque is accomplished through magnetic lines of force between the stationary pole ring and the revolving rotor. Therefore, only magnetic lines are broken with the result there is no wear, nor replacement of frictional surfaces. The result is no maintenance. Direct current excitation of the stationary field poles is obtained through a step-down transformer and a selenium rectifier.

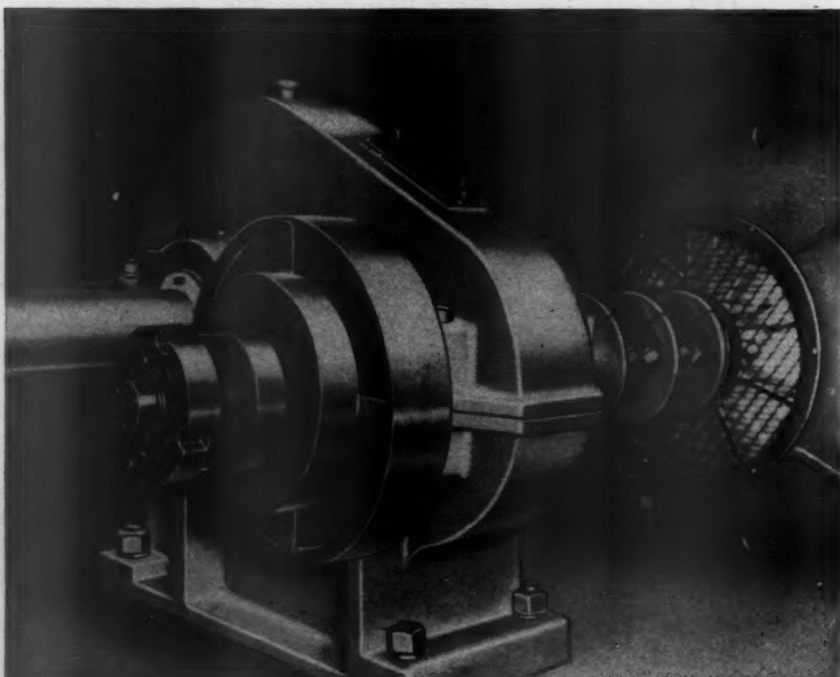
The simplicity and the few parts necessary makes Magnetorque control applicable for use with either a simple drum control, or full magnetic control. Safety precautions included in this control consist of a current relay connected into the



Magnetorque unit installed on a typical P & H crane trolley assembly

Magnetorque field circuit. This insures energizing the unit before the motor directional contactors can be energized. Failure of current in the unit will result in opening of this current relay, automatically disconnecting the hoist motor from the line and immediately setting the electric motor brake.

When desired, an all-position dynamic feature is available, consisting of a small auxiliary self-excited generator mounted on the Magnetorque unit. Regardless of controller position, ("off" or any "running" position), the load cannot drop or gain excessive speed in case of a power and electric motor brake failure. When the descending load overhauls the hoisting unit, it starts the generator action to excite the Magnetorque unit, thereby retarding the load to safe lowering speeds. This generator is open circuited under normal operation and is only inserted in the circuit when the main line disconnect switch is open, or in the case of power failure. This all-position dynamic braking feature is similar to the dynamic braking safety feature obtained on d.c. cranes, equipped with series-wound motors. It is designed to provide the same safety as the time-tested d.c. dynamic braking cir-



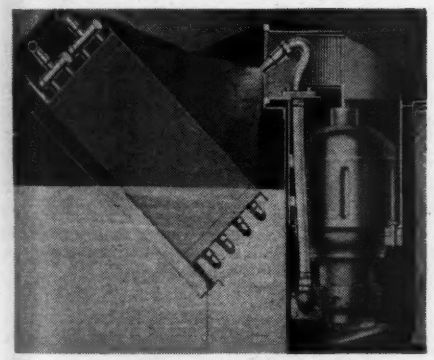
All-position dynamic breaking generator mounted on the hoisting unit

cuit which has been looked upon as providing the best speed regulation and the safest crane control system.

The best features of d.c. dynamic braking are said to be incorporated in the new Magnetorque control, making the use of a.c. power cranes more desirable, with important economics in power cost and maintenance as well as assuring fine speed control. The new P & H magnetic crane control unit is expected to prove particularly advantageous for powerhouse, machine shop, foundry and other crane applications.

Subcoolers for Air Conditioning

Waukesha evaporative sub-coolers, which serve as air-conditioning capacity boosters, are now being made of silicon bronze and stainless steel to meet the requirements of corrosion and abrasion. They are designed to increase air-conditioning system capacity, and are built to fit within available spaces. Air condensers are adequate for nearly all operating conditions, and the sub-coolers are required to function only under maximum temperatures. This represents only a small portion of the time. By means of the sub-cooler, the capacity of a Waukesha Ice Engine is raised from 5½ to nearly 8 tons at 120 deg. F. This requires about



Sectional view of a subcooler showing sump and condenser coils—At the right is the motor, pump, spray nozzle, blower and air filter

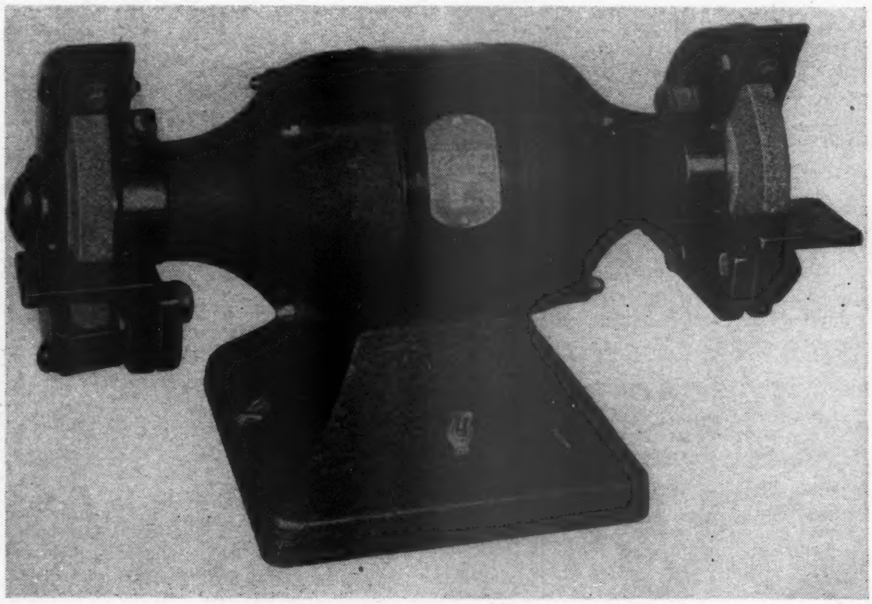
four gallons of water per hour from the car supply.

The essential parts of the sub-cooler which is manufactured by the Waukesha Motor Company, Waukesha, Wis., are condenser coils which carry the refrigerant, a motor driving a centrifugal pump and a blower and the control equipment. When the outside temperature rises to a certain value, it causes a thermostatic pilot switch to close. Water from the car supply is admitted to the subcooler sump by the opening of a solenoid control valve, and the level is maintained in the sump by a direct-acting float valve. At the same time, the electric motor driving the pump sprays water over the condenser coils while the blower draws air in through a filter and directs a blast across the cooling surfaces. When the outside temperature drops to a predetermined point, the thermostatic pilot switch opens the circuit. This causes the water supply to be cut off, and the pump and blower to stop.

Bench Grinder

The Standard Electrical Tool Company, Cincinnati 4, Ohio, has added the Type 4BAS4 bench grinder to its Cadet line.

The grinder has two 6-in. by ¾-in. by ½-in. grinding wheels, 16½ in. apart. The spindle center is 6¾ in. above the bottom of the base. Power is furnished by a ⅛-hp. motor with a speed of 3,600 r.p.m. The grinder can be supplied with either a motor operating on single-phase, 50- or 60-cycle, 110-volt power or 220-volt single-phase current. A double-pole toggle switch is located in the base.



The Cadet Type 4BAS4 bench grinder

Other features are the safety-type enclosed wheel guards, an adjustable spark breaker and a work rest. Safety glass eye shields and a floor pedestal are available as extras. The net weight of the grinder is 60 lb.

Coating for Paint Spray Booths

A coating compound for use on the walls of paint spray booths, announced by the Detrex Corporation, Box 501, Detroit 32, Mich., can be used for facilitating maintenance of both wet and dry spray booths, but has characteristics that makes it especially advantageous for use on the walls of dry booths.

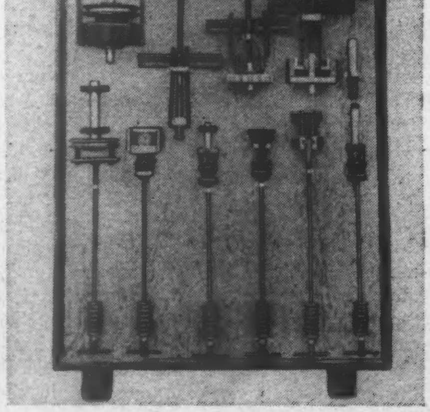
Triad PRD, as the new compound is called, is a light-colored, semi-liquid material applied to the booth walls with a brush or spray gun. For spraying, a 20 per cent dilution (4 parts of Triad to 1 part water) produces a viscosity that can be handled in a pressure tank. This material can be brushed on as it comes, although a 10 per cent dilution with water usually provides a better consistency.

Triad PRD dries and forms a continuous white coating to which paint overspray adheres. When necessary to clean the booth, the coating compound with adherent paint film is readily scraped off without previous soaking, or it can be easily removed by flushing with either hot or cold water. Paint overspray adhering in a solid film can be peeled off in a sheet.

By greatly cutting down booth clean-up time, and making the job much easier to do, Triad PRD is said to effect important savings in spray booth maintenance and without any fire or health hazard due to the application of this material.

Master Puller Set

Designed to save both time and money, a master puller set announced by the Plomb Tool Company, Los Angeles 54, Calif., furnishes the equipment needed for



The Plomb master puller set, showing a few of the jobs it will handle

many puller jobs. With the parts furnished it is possible to assemble any Plomb slide hammer, light-duty, medium-duty or heavy-duty puller. In addition, the set includes a wheel puller, a blind bearing puller, a single-jaw puller and a cap-screw cross-arm.

The puller set, designated as No. 4000-AA, has 42 items. Because of the interchangeability of the parts, a wide variety of puller set-ups can be made for various jobs.

Automatic Welder

Everything needed for automatic welding, including a head, control equipment, welding transformer and work positioning equipment is available in a complete package of automatic welding equipment engi-

The operation shown consists of welding the hub to the end bell of a motor

neered, built, and sold by the Westinghouse Electric Corporation.

The standard weldomatic head, suitable for welding with a.c. or d.c. operates with a capacity of 1,200 amp. a.c. Special nozzles are available for 2,000 amp. a.c. Its capacity for d.c. welding is 800 amp. The head is so designed that it can be rotated 360 deg. in the vertical or horizontal plane. As a result, it can be mounted in any position for welding. Nozzles and knurled drive wire feed rolls are supplied to accommodate $\frac{1}{8}$-in., $\frac{5}{32}$-in., $\frac{3}{16}$-in. and $\frac{1}{4}$-in. wire diameter. Wire feed is automatic. The speed of the driving motor is controlled by the burn off rate of the welding wire through a bridge hook-up consisting of arc voltage, control generator field and a potentiometer.

The motor-generator set is driven by a 2-hp., 220/440-volt, 3-phase, 60-cycle a.c. motor. A 2-pole constant-potential generator supplies the control current and a 2-pole variable-voltage generator supplies current to the driving motor in the head. Control relays and contactors required in the operating circuit are mounted in the control panel. Control equipment for starting and stopping the welding arc and traverse mechanism, as well as adjustment for arc length, is mounted on the operator's panel.

The work positioning equipment is supplied as needed for the job from semi-standard designs of travel carriages, mounting pedestal, rotator, positioner and turning rolls.

Geared-Head Engine Lathes

A series of light motor-driven geared-head engine lathes, designated the Tray-Top Cintilathe, and featuring tray areas for holding small tools, is manufactured by the Cincinnati Lathe & Tool Co., Oakley, Cincinnati 9, Ohio. The all-geared twelve-speed headstock as well as the quick-change gear box and apron contain flame-hardened high-carbon alloy-steel gears. A splined leadscrew serves as both a leadscrew and a feed rod. The sustained accuracy of thread cutting as affected by the accuracy and size of the leadscrew is said to be enhanced because a more generous size combination leadscrew and feed rod can be employed than where two individual members are used. The leadscrew reverse is contained in the gear box, which eliminates a reverse plate.

The Cintilathe is offered in four nominal swing sizes, 10 in., 12½ in., 15 in. and 18 in., with distances between centers from 18 in. up in increments of 6 in. The motors supplied as standard are 1, 1½, 2 and 3 hp. respectively, for each of the four swing sizes. Twelve spindle speeds give a standard range on the 10-in. and 12½-in. machines from 30 to 1,200 r.p.m. and 20 to 820 r.p.m. on the 15-in. and 18-in. machines. Optional high-spindle-speed ranges available are from 45 to 1,800 r.p.m. on the two small sizes and 30 to 1,200 r.p.m. on the larger machines. Speed changes are obtained by a three-lever shifting arrangement in which the levers operate on a common center with a direct-reading speed dial.

All shafts in the headstock are mounted in Timken bearings and the entire transmission is lubricated by a splash system. The spindle on the 15-in. and 18-in. machines is mounted on two tapered and one straight roller bearing while the spindle on the 10-in. and 12½-in. sizes is mounted on two tapered roller bearings. The hole through the spindle is 1¼ in. on the two small machines, and 1½ in. on the larger machines.

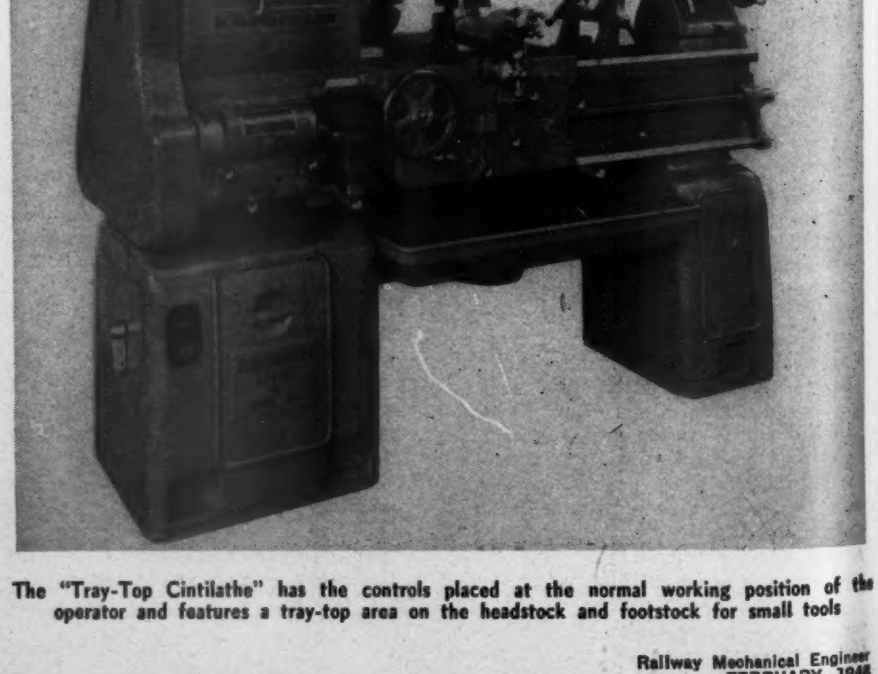
Two optional drives are available, one with a direct-coupled motor drive, whereby starting, stopping and reversing is by means of an electrical drum switch which incorporates a jog position; or the lathe can be equipped with a multiple-disc friction clutch and brake. In either case a V-belt drive is employed. Forty-eight thread and feed changes are incorporated.

Weatherized Fluorescent Fixtures

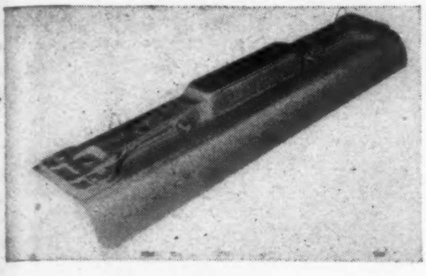
With the introduction of its re-styled HF-100 fluorescent fixture, Sylvania Electric Products, Inc., Salem, Mass., has announced the complete "weatherizing" of its industrial fixture line by means of a finish which makes the fixtures highly resistant to rust, corrosion, pitting and crazing.

In addition to its protective qualities, the white Miracoat finish on the reflector furnishes a reflection factor of not less than 86 per cent.

Other improvements in the remodeled fixture include hook slots in both sides of the tophousing for easy mounting with specially developed, single hanger hooks supplied with the unit, and a turned down lip to provide greater rigidity and lessen



The "Tray-Top Cintilathe" has the controls placed at the normal working position of the operator and features a tray-top area on the headstock and footstock for small tools



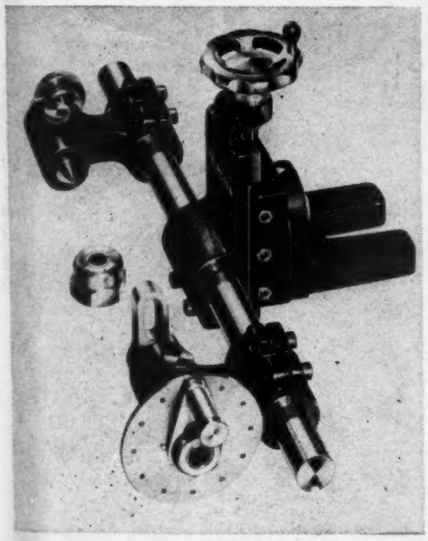
The Sylvania type HF-100 fluorescent lighting fixture

possible collection points for dust, lint and moisture. To further simplify cleaning and inspection of ballast and wiring, the reflector is attached to the tophousing by means of captive latches from which it can be detached without removing any nuts, bolts or similar devices.

Designed as a 2-lamp, 40-watt fixture, the HF-100 is equipped with a pair of knockouts to provide for another lamp, thus converting to a 3-lamp HF-150 fixture, if desired.

Indexing Milling Attachment for Lathes

An indexing and milling attachment for performing such milling operations on engine lathes as cutting gears, splines,



The No. 300 Palmgren indexing milling attachment

keyways, oil grooves, slots, square shafts, hexagons, and flats on circular pieces, has been developed by the Chicago Tool & Engineering Co., 8383 South Chicago avenue, Chicago 17. Work can be held between centers or in a collet chuck.

Model No. 300 will take work up to 4 in. in diameter and 11½ in. between centers when an 18-in. supporting bar is used. This attachment will fit lathes with tool posts up to 1¼-in. diameter. Head and tailstocks are held by keys on a supporting bar which has a full length keyway for horizontal movement.

A vertical feed travel of 1½ in. is provided by a dovetail-type slide and a fine screw adjustment. Gibs have adjusting screws for wear takeup. A chuck with a ½-in. capacity collet, tailstock center and one 12-hole indexing plate and arm are furnished with the attachment. Other indexing plates can be furnished for other divisions.

Grille for Diesel Locomotives

General Electric engineers have developed a lightweight metal grille to satisfy both the engineer and the designer of streamlined Diesel locomotives.

The grille, which forms the decorative metal on the side of the Diesels, permits a sufficient flow of air to pass through it and be filtered for 2,000-hp. engines. At the same time, it may be fabricated in practically any pattern that may be wanted.

The General Electric lightweight grille has louver sections strung on wire

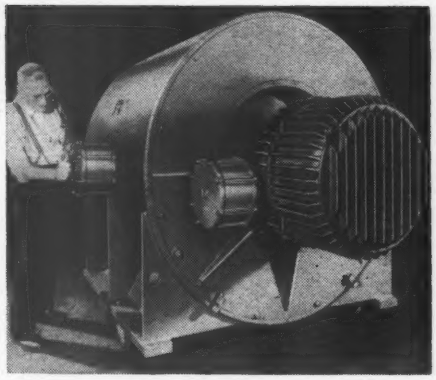
The process of manufacture used joins together strips of cold-rolled steel under tension and utilizes spacers connected to wires rather than conventional nuts and bolts.

The steel louver sections, which have a thickness of .025 to .030 in., are strung like beads on strands of stainless steel. This factor aids design innovations and decreases the over-all weight. The grille causes almost no restriction of air and has the appearance of being a closed panel section.

Totally Enclosed Motors

A line of improved totally-enclosed fan-cooled, wound-rotor motors has been announced by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis. The motors are built with an improved tube-type air-to-air heat exchanger, first used for squirrel cage motors. The greater efficiency of this exchanger permits a reduction in size compared to older, totally-enclosed, fan-cooled designs. Because of its simple design, cleaning is seldom necessary.

To assure trouble-free operation under extremely unfavorable atmospheric conditions, the motors can be built with stainless steel ventilating tubes, fans, and end plates and cast iron terminal boxes and collector ring enclosures.



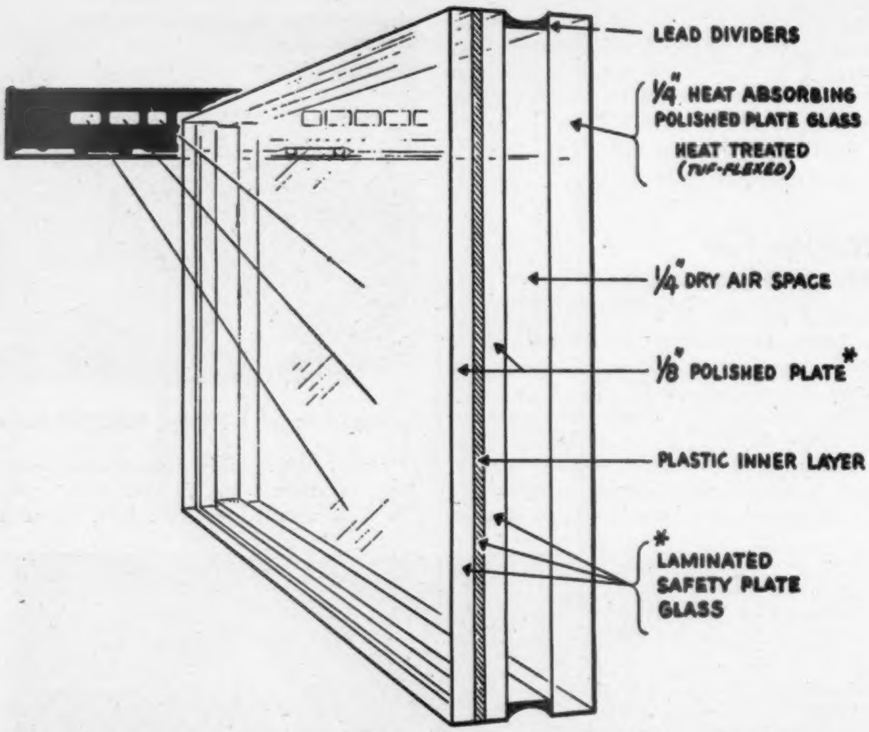
An application of a 500-hp., 2,300-volt motor

Built with these special features, the 500-hp., 705-r.p.m., 2,300-volt motor shown is to be used for driving a centrifugal pump in a midwestern chemical plant. Its collector assembly is cooled by radiation, with internal air circulation provided by fan blades mounted on the collector assembly.

Double-Glass Unit For Railroad Windows

Railroad Thermopane, a double-glass unit developed by the Libbey-Owens-Ford Glass Company, Nicholas-Winslow Bldg., Toledo 3, Ohio, for passenger-train windows, is composed of three panes of plate glass, the inner two of which are ⅛-in. plate laminated with plastic to form safety glass while the outer pane is ¼-in. heat-absorbing plate. Between them is a ¼-in. space of dehydrated air, permanently sealed in by a patented metal-to-glass bond along the four edges of the glass.

An insulating unit by reason of the dehydrated air, the glass is said to increase the efficiency of heating and air conditioning equipment and also to resist frosting and fogging. Because it is a single unit sealed



Composition of the double-glass construction in the Special Railroad Thermopane for passenger-car windows

against infiltration of dust and dirt, only two surfaces need be cleaned, thereby reducing maintenance time between runs.

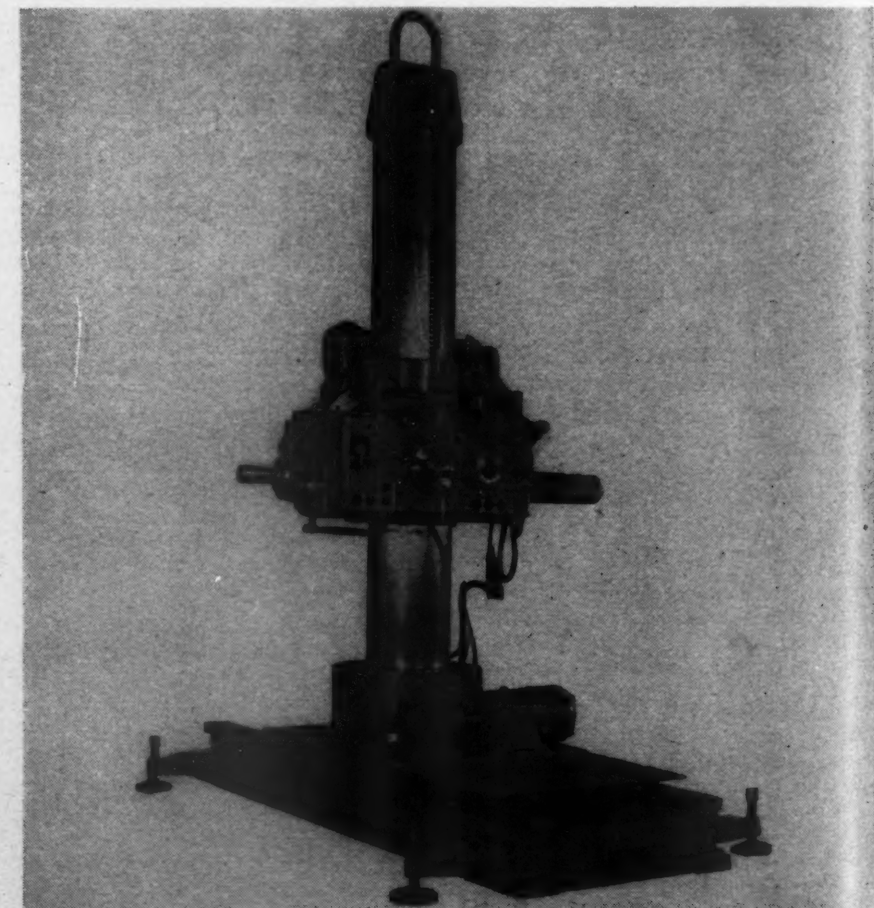
The outer heat-absorbing glass helps to cut down heat rays from the sun and substantially reduces glare. This pane may also be heat-tempered for extra strength if desired. The inner surfaces of the unit are permanently cleaned at the factory, and the unit need never be dismantled; no dehydration capsules are used.

Portable Drilling And Tapping Machine

The Kaukauna portable horizontal drilling and tapping machine has a tilting horizontal head and full three-dimensional power traverse and swiveling of the headstock for performing drilling and tapping operations throughout the range of 45 deg., above or below the horizontal spindle position. The machine spindle can be placed in virtually any position for drilling and tapping by the power elevation of the headstock on the column, the column and subbase power traverse on the runway, the tilting of the headstock 45 deg. above and below the horizontal, and the rotation of the column 360 deg. on its subbase.

The machine has a fine feed to the spindle through a micrometer handwheel. An adjustable calibrated depth gauge with an automatic trip throws out the feed at any predetermined depth within 6 in. of the spindle travel, the starting point being anywhere within the total spindle traverse. A single lever controls three feeds; a rotary selector lever with an indicating dial cares for speed changes; an automatic tapping device with an adjustable dial for tapping to a depth of 5 in. is incorporated. Right or left spindle rotation is set with a selector switch. Locking clamps may be engaged to prevent unit movements. A lifting bail facilitates handling with an overhead crane.

This product of the Kaukauna Machine Corporation, Kaukauna, Wis., has nine spindle speeds, three spindle feeds, a 24-in. longitudinal continuous travel of the spindle and a 48-in. horizontal travel of the column on the runway.

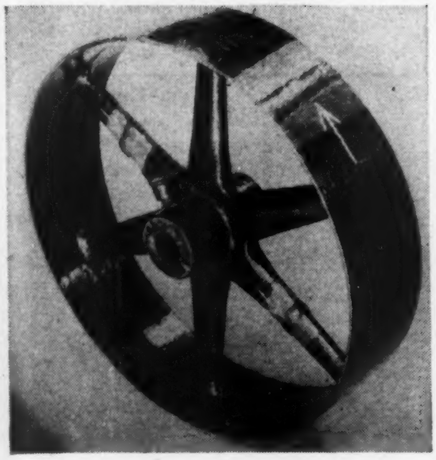


The No. 1030 Kaukauna portable horizontal drilling and tapping machine

Flux-Coated Gas Rod for Cast Iron

Designed for all types of gray or alloy cast iron and to eliminate the uncertainties and delays of manual fluxing when welding stressed cast shapes, a color-matching flux-coated torchwelding rod known as "EutecRod 14 FC" has been announced by the Eutectic Welding Alloys Corporation, 40 Worth street, New York 13. This rod develops a tensile strength of 48,000 lb. per sq. in. in the weld deposits, bonding at 950 deg. to 1400 deg. F., with a remelt temperature of 2200 deg. F. Its coefficient of expansion is the same as that of gray cast iron, and its hardness is approximately 190 Brinnell.

The illustration shows welds in the stressed areas of a cast-iron pulley which were accomplished with an oxy-acetylene flame, a slight preheat of 200 deg. F., using a No. 5 tip held at a distance of 3/8 in. from the flame cone to the surface metal. The principle of flux-coating is said to make it possible to achieve fast, smooth welds on cast iron with very little fusion of base metal, and with correct fluxing automatically maintained at every point during the weld. All broken sec-

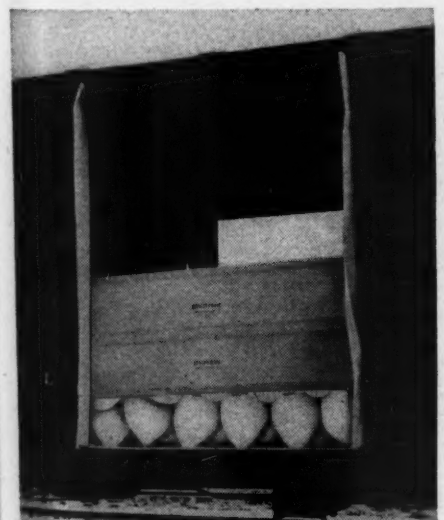


Cast-iron pulley 16 in. in diameter with a 4-in. rim welded in three highly stressed areas with flux-coated "EutecRod" 14 FC

tions or cracks in this pulley were beveled to 75 deg. to 90 deg. A forehand welding procedure was used to melt the flux and filler metal, after heating the welding area to a dull red.

Car Door Strips

A car door retaining strip which replaces the conventional type door barricade and uses no lumber is manufactured by the Signode Steel Strapping Company, 2600 North Western avenue, Chicago. The strips of laminated, heavy-duty water-repellent Kraft liner board, reinforced with ¾-in. by .020-in. Signode steel strap-



Signode car-door retaining strips in place in a box car

ping, are nailed across the door opening inside the car. Depending upon the characteristics and weight of the load, the strips may be butted, overlapped or spaced for maximum efficiency. The average dunnage for a door will range from 10 to 20 lb. Retaining strips are 18 in. by 84 in.

The substitution of the smooth-surfaced retaining strips for wood-constructed door bracings is reported to eliminate the need for car doorway liners and damage to cartons, boxes, bales, bags and bundles from snagging and ripping on sharp edges, corners and protruding nails. It is not necessary to knock in a doorway barrier, as unloaders need only snip the steel bands on the retaining strips, thus reducing damage to containers near the doorway.

Electric Arc Cutting Tool

A rod which can use the same source of current from standard arc-welding machines for cutting instead of for welding is manufactured by the Eutectic Welding Alloys Corporation, 40 Worth street, New York 13. Known as the CutTrode, it is designed to couple the highest available concentrated heat with specific chemicals and metals in the coating to focus and direct this heat for metal cutting.

CutTrode consists of a metallic core, surrounded by a specifically designed sheath

Steel plate, as well as the more difficult to cut metals, such as aluminum, bronze, and stainless steels, may be sheared by a pair of CutTrodes, which carry an exothermic coating for focusing and intensifying the energy of the electric arc

or coating which is extraordinarily resistant to heat at very high current ranges. This coating serves to focus and intensify the energy of the electric arc, which is generated when CutTrode is struck like a match against a piece of steel or any other metal and then actually pushed through that metal. By virtue of the chemical elements in the coating, the arc is focussed and directed into the metal to be cut. It pierces holes in such metals as cast iron, stainless and other alloy steels, aluminum, bronzes, etc. These metals may be pierced without first drilling them. Laminated materials may also be cut. Broken taps and bolts may be burned out.

Welding Generator

A welding generator, rated 300 amp., is now being made by the Harnischfeger

The generator is intended for use by those who wish to build their own welder

Corporation, Milwaukee 14, Wis. Its welding range is from 30 to 375 amp. and it is offered to those who wish to build their own d. c. welder. Called the Model WG-300, it is designed for easy coupling to a gasoline engine or power take-off. A V-belt pulley arrangement makes exact alignment between power and generator unnecessary, thereby simplifying the building of the welder. In addition to saving space, this also provides a more correct relationship between engine and generator speeds. The P & H "Visa-matic" calibration plate permits accurate selection of the correct welding current for all classes of electrodes.

NEWS

Simmons-Boardman Subscription Sales Representative

Marlowe H. Plant, of Elmhurst, Long Island, N. Y., has succeeded D. M. Dudley as subscription sales representative for the Simmons-Boardman Publishing Corporation in the following states and provinces of Canada: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Maryland, Delaware, District of Columbia, Virginia, Quebec, Canada, and New Brunswick.

A. A. R. Mechanical Division to Meet in June

The next annual meeting of the Mechanical Division of the A. A. R. will be held at the Congress Hotel, Chicago, June 28, 29 and 30. This is strictly a business session of the Division and it is not planned to hold any exhibition of railway equipment and supplies.

Painting Truck Sides and Parts

In an A. A. R. circular letter dated January 9, paragraph (t) (3-e) of interchange inspection Rule 3 is modified, effective January 1, to read as follows:

"(t) (3-e) New or secondhand truck sides, truck bolsters and car wheels must not be painted, except the inside of journal boxes may be painted with a primer coat if desired."

Exception was made to side frames and bolsters now on hand at construction plants which were painted (after inspection) by the manufacturers before shipment. These may be applied to cars outshopped after January 1, 1948, without removing the paint, but no more side frames or bolsters may be painted.

Air Brakes and Journal Boxes Out of Date

An A. A. R. Mechanical Division letter dated December 30 calls attention to interchange inspection rules 60 and 66 which require that where stenciling so indicates, cars overdue for periodic attention to air brakes or journal boxes must be given this attention by the railroad or car owner having such cars in its possession.

The circular states that information reported by a number of roads serving busy loading terminals shows an ever-increasing number of cars arriving overdue for this periodic attention, and it is evident that a great many roads and car owners are not performing their proper proportion of this work. The complaints are substantiated by the Mechanical Inspection Department's routine investigations conducted on 62 railroads and at 24 private car owners' plants. One day's actual inspection showed that cars outshopped having journal boxes or air brakes overdue for periodic inspection and attention totalled 142 for journal boxes and 23 for air brakes, including private car owners; empty cars in yards approved for service having journal boxes or air brakes overdue for periodic inspection and attention numbered 297 and 39, respectively; empty cars at freight houses approved for service having journal boxes or air brakes overdue for periodic inspection and attention amounted to 56 and 7, respectively.

The matter has been before the Arbitration Committee and the situation is not considered to be at all satisfactory, particularly as to cars released from repair tracks when they are overdue for periodic attention to air brakes or journal boxes or both. This results in subsequent shopping of cars and holding them out of service for this work, involves unnecessary additional expense and is an unfavorable factor with respect to the car supply situation.

The circular requests that all railroads and private-car owners check these conditions on their shop and repair tracks and take steps to correct the situation.

Monon Converts G. I. Cars—A Correction

The paragraph directly under the illustration in the second column of page 70 of the January *Railway Mechanical Engineer* should read as follows:

"Two types of sliding doors are used for handling baggage and mail. In the baggage [not baggage-mail] cars the doors were constructed from sheet aluminum and extruded aluminum channels. They slide on Z-bar slider tracks. Two of the doors are 6 ft. wide and two are 8 ft. wide, an 8-ft. door being placed opposite a 6-ft. door. The doors on the baggage-mail cars were fabricated from Met-L-Wood."

Orders and Inquiries for New Equipment Placed Since the Close of the January Issue

Road	No. of locos.	Type of loco.	Builder
Baltimore & Ohio	40[1]	1,000-hp. Diesel-elec. switch.	Electro-Motive
	25[1]	1,000-hp. Diesel-elec. switch.	Baldwin
	25[1]	1,000-hp. Diesel-elec. switch.	American Loco.
	10[1]	1,000-hp. Diesel-elec. switch.	Fairbanks-Morse
Missouri-Kansas-Texas	16[2]	Diesel-elec. A units	Electro-Motive
	4[2]	Diesel-elec. B units	Electro-Motive
	16[2]	Diesel-elec. A units	American Loco.
	8[2]	Diesel-elec. A units	Baldwin Loco.
Reading	3[3]	6,000-hp. Diesel-elec. frt.	American Loco.
	3[3]	6,000-hp. Diesel-elec. frt.	Electro-Motive
Southern Pacific	20[4]	6,000-hp. Diesel-elec. frt.	Electro-Motive
	10[4]	1,000-hp. Diesel-elec. switch.	Baldwin Loco.
	10[4]	1,000-hp. Diesel-elec. switch.	American Loco.
Texas & Pacific	11	1,000-hp. Diesel-elec. switch.	Electro-Motive
	1	1,500-hp. Diesel-elec. switch.	American Loco.
Toledo, Peoria & Western	1[5]	3,000-hp. Diesel-elec. frt.	Electro-Motive
Western Maryland	2[6]	1,500-hp. Diesel-elec. road switch.	Baldwin Loco.

Freight-Car Orders

Road	No. of cars	Type of car	Builder
Lake Superior & Ishpeming	200	70-ton ore	Bethlehem Steel
Spokane, Portland & Seattle	500	50-ton box	Northern Pacific shops
	20	16,000-gal. tank	General American

Freight-Car Inquiries

Road	No. of cars	Type of car	Builder
Chicago, Rock Island & Pacific	500	70-ton hopper	
	1,000 or 2,000	50-ton box	
Clinchfield	1,000	50-ton hopper	
New York, Chicago & St. Louis	400	70-ton gondola	

Passenger-Car Inquiries

Road	No. of cars	Type of car	Builder
New York Central	30[7]	Multiple unit	

[1] Deliveries scheduled to begin during the third quarter of 1948 and to be completed before the close of the year. The new equipment will enable the B. & O. completely to equip with Diesel power its terminals at Cincinnati, Ohio, Youngstown, Warren, and Pittsburgh, Pa.

[2] The M-K-T expects that all the units, the total estimated cost of which is $7,000,000, will be delivered early this year. The new units will be used to make up 4 4,500-hp. A-B-A and 16 3,000-hp. A-A locomotives. The order was placed in November.

[3] Each of the locomotives, which were ordered in November, will cost approximately $600,000. Delivery of the first is scheduled for the second quarter of 1948 and the other five will be delivered during the third quarter of the year.

[4] Delivery expected to begin during the third quarter of 1948 and scheduled to be completed by the second quarter of 1949.

[5] These locomotives, the order for which was placed in November, are for delivery during the second quarter of this year.

[6] This locomotive, which is the first Diesel for the T. P. & W., cost $275,000. More Diesels are expected to be ordered this year. The road also plans to spend $750,000 for deferred maintenance.

[6] For delivery during the second quarter of this year.

[7] These cars, which will be air-conditioned, are about 10 per cent of the N. Y. C.'s requirements to fulfill its recently announced program to improve suburban service. Among other improvements called for in the overall program is the installation on 25 more multiple-unit electric cars, as soon as equipment can be obtained, of the system of voltage regulation which is in experimental use on several N. Y. C. cars. The system is reported to increase the amount of light in commuter cars by about 60 per cent and to eliminate lighting fluctuations caused by voltage variations in the third rail.

Squeeze Test Applied After Ten Years' Service

Ten years' continuous service over 2,500,000 miles has had no appreciable effect on the structural strength of the all-stainless steel Budd-built railway car which was subjected to tests in the company's laboratory here, according to General Gladeon M. Barnes, vice-president in charge of engineering of the Budd Company, Philadelphia, Pa.

The tests, a joint operation by engineers of the Budd Company and the Atchison, Topeka & Santa Fe, were conducted under the supervision of Dr. Michael Watter, chief of Budd's Research and Development Division. They were observed by an official representative of the Association of American Railroads. Testing operations took place in Budd's testing plant.

This car is one of 100 chair cars delivered to the Santa Fe during 1937 and was built before the present higher-strength requirements for railway passenger cars were established. After a review of the original engineering analysis, the railroad was assured that, because of the corrosion-resistant character of the stainless-steel structure, the strength margins in the car as originally built were adequate to meet the present A. A. R. requirements of 800,000-lb. compression loads, with minor reinforcements to various low-alloy steel elements of the structure including the end underframe unit, coupler, coupler carrier, center plate, and collision posts. No modifications were made to the stainless-steel structure. The car withstood the 800,000-lb. compression load without permanent deformation and without cracking a single window pane. All glass had been left in place for the test.

Shortly after the test the car was returned to service by the Santa Fe.

Supply Trade Notes

Vapor Heating Corporation. — The *Vapor Car Heating Company, Inc.,* with headquarters at Chicago, has changed its name to the Vapor Heating Corporation.

◆

Chicksan Company. — *L. C. Meyers,* who has been handling field service in California for the Chiksan Company, has been assigned to the Rocky Mountain area, covering Colorado, Wyoming and Montana, with headquarters in Denver, Colo., and *Robert Jones,* formerly a member of Chiksan's engineering staff for the past several years, has been assigned to the New York office as sales engineer in that territory.

◆

Magnus Metal Corporation.—*W. H. Croft, Sr.,* president of the Magnus Metal Corporation, with headquarters at Chicago, has been appointed chairman of the board of directors. *W. H. Croft, Jr.,* executive vice-president, succeeds the elder Mr. Croft as president. Among other new appointments are: first vice-president, *W. P. Carney;* vice-president and controller, *J. P. Borda;* vice-presidents, *N. P. Lyons, J. E. Brown, W. D. Hickey, G. A. Murphy, M. J. Turner* and *G. F. Mueller;* assistant to president, *C. L. Kyle,* and chief engineer, *R. J. Shoemaker.*

W. H. Croft, Sr.

W. H. Croft, Sr., entered the employ of the Hewitt Manufacturing Company (later Magnus Metal Corporation) in 1893, and since that date has served in various executive capacities. He became first vice-president in 1915 and president in 1927.

W. H. Croft, Jr.

W. H. Croft, Jr., joined the Magnus Metal Corporation in 1927, and from March, 1934, to December, 1935, was manager of the company's Topeka (Kan.) plant. On January 1, 1936, he was appointed assistant vice-president, with headquarters at New York, and in November, 1947, executive vice-president.

W. P. Carney has been associated with Magnus Metal since 1902, becoming assistant to vice-president in charge of sales at New York, in 1910. He was appointed vice-president in charge of sales at Chicago in 1927.

◆

Bowser, Inc.—*Bruce W. Grosvenor,* formerly sales manager of the general line division of Bowser, Inc., has been appointed district manager of the sales and service office at Albany, N. Y., to succeed *I. D. Bone,* who has resigned after 27 years of service with the company.

◆

Joseph T. Ryerson & Son, Inc.—*Alfred J. Olson* has been appointed an assistant sales manager of the Chicago plant of Joseph T. Ryerson & Son, Inc., to succeed *Ray C. Page,* who has been appointed sales manager of the company's new steel service plant under construction in the San Francisco, Calif, area.

Robertshaw-Fulton Controls Company.—The *Robertshaw Thermostat Company,* of Youngwood, Pa., the *Fulton Sylphon Company* of Knoxville, Tenn., and the *Bridgeport Thermostat Company* of Bridgeport, Conn., have been merged under the name of the Robertshaw-Fulton Controls Company. *John A. Robertshaw* is president of the new organization.

◆

Eastern Carbide Corporation.—A new corporation, the Eastern Carbide Corporation, has been organized at 909 Main street, New Rochelle, N. Y. *Anthony J. Allen,* formerly assistant products manager of the Firth-Sterling Steel & Carbide Corp., is president of the new corporation and *Walter A. Ruppel,* also formerly with Firth-Sterling, is secretary-treasurer.

◆

Wilson Welder & Metals Co.—*Thomas B. Hasler,* formerly president of the Wilson Welder & Metals Co., a wholly-owned subsidiary of the Air Reduction Company, has been elected chairman of the board of directors to succeed *C. E. Adams,* who resigned as chairman and director and *F. B. Adams, Jr.,* has been elected president and a director.

◆

Champion Rivet Company.—*Frank M. Sweeny* of 4136 Roland avenue, Baltimore, Md., has been appointed Baltimore district sales agent of the Champion Rivet Company to handle the sales of rivets and welding electrodes for railroads and industrial users in Baltimore, Washington, D. C., Richmond, Va., and Norfolk. *L. Gilbert* has been appointed welding electrode sales representative in the New York area, with headquarters at 30 Church street. *Raymond B. Johnson* has been appointed Philadelphia district sales manager for the Champion Rivet Company, to succeed *W. H. S. Bateman,* retired. The Philadelphia, Pa., office will now be a direct sales branch office.

◆

Hanchett Manufacturing Company.—*Alvin Haas* has been appointed vice-president and general manager of the Hanchett Manufacturing Company, Big Rapids, Mich. Mr. Haas was formerly president and general manager of Yates-American at Beloit, Wisc., for 17 years.

Farnsworth Television & Radio Corp.—*Abner G. Updike* and *G. K. Dickenson* have been appointed sales managers of the Mobile Communications Division of the Farnsworth Television & Radio Corp. Mr. Updike will be in charge of sales in the New England and East Central states and Mr. Dickenson will handle sales in the West Central and Southwestern states.

◆

General Electric Company.—*Henry V. Erben* has been elected a vice-president of the General Electric Company, to succeed *Roy C. Muir,* who has retired after more than 42 years of service. Mr. Erben, who was formerly a commercial vice-president and assistant general manager of the apparatus department, has been appointed also general manager of the department.

◆

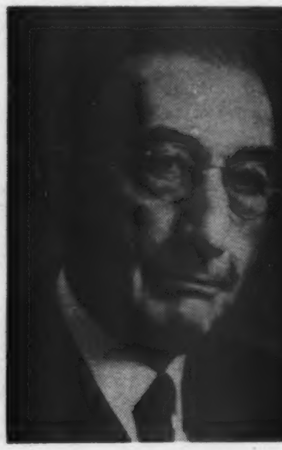
American Locomotive Company.—*William L. Lentz,* vice-president and Administrative Committee member of the American Locomotive Company, has added to his present duties those of *J. B. Ennis,* senior vice-president, who has retired. *Frank J. Foley,* former director and vice-president, who has been serving as a consultant for the last year, has also retired.

William L. Lentz's new duties will be in addition to those handled by him during 1947 as a vice-presidential member of the company's Administrative Committee. They will include general railroad engineering

W. L. Lentz

contacts, studying and promoting progress and improvements in motive-power designs for domestic and foreign railroads, research and assistance to all divisions in their engineering and manufacturing acivities. Mr. Lentz, who during the last war was in charge of the company's Schenectady, N. Y., plant began his railroading career in 1913, completing a special apprentice course in the locomotive shops of the New York Central. Following World War I service as an Army Aviation Corps lieutenant he rejoined the N. Y. C. and climbed to the position of engineer of motive power in the engineering department at New York. He joined the Standard Stoker Company in New York as assistant to the vice-president and sales manager in 1937. He was appointed manager of the American Locomotive Company's Schenectady, N. Y., plant in 1940 and became vice-president in charge of manufacturing in 1945.

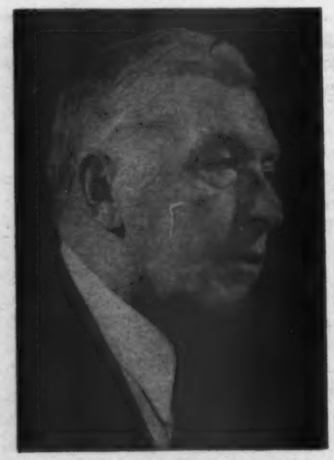
J. B. Ennis has been associated with American Locomotive and predecessor companies since 1895 when he joined the



J. B. Ennis

Rogers Locomotive Works as tracer, detail draftsman, and elevation draftsman. He became vice-president in charge of engineering in 1917; a senior vice-president in 1941, and a director in 1924. In 1944 he was awarded the Henderson Medal of the Franklin Institute "in consideration of his accomplishments in locomotive engineering."

Frank J. Foley began his railroading career in 1893 in Newark, Ohio, as a messenger boy for the Baltimore & Ohio. Subsequently he served as telegraph operator and train dispatcher on several middle western railroads. In 1897 he entered the manufacturing department of the Pullman Company. From 1902 to 1912 he was in charge of various plants of the Railway Steel Spring Company. In the latter year he became general superintendent of the company; in 1919 vice-president in charge of sales and in 1927



F. J. Foley

vice-president of the American Locomotive Company, which earlier had absorbed the Railway Steel Company now known as the Railway Steel Spring Division of the American Locomotive Company.

◆

Ransome Machinery Company.—*W. H. Scherer,* formerly assistant to the vice-president in charge of manufacturing of the Worthington Pump & Machinery Corp., has been appointed general manager and elected a director of the Ransome Machinery Company, Dunellen, N. J., a subsidiary of Worthington. Mr. Scherer has been acting manager of Ransome since June, 1947.

◆

Minneapolis-Honeywell Regulator Company.—*Roy H. Warmee,* sales promotion manager of the Minneapolis-Honeywell Regulator Company since 1940, has been appointed sales manager of the company's Moduflow division. *John Randall,* who has been serving as temporary manager of that division, has resigned. Sales promotion activities, formerly supervised by Mr. Warmee, will henceforth be managed by *John A. Young,* formerly assistant in the department.

◆

Ajax-Consolidated Company.—*Albert W. Faulconbridge,* formerly production manager and manager of the Railroad Division of the Haskelite Manufacturing Corporation, has been elected vice-president of the Ajax-Consolidated Company, with headquarters at Chicago.

Albert W. Faulconbridge served his apprenticeship as a carbuilder with the Canadian Pacific. He was also associated with the Canadian National, and during World War II was production manager of Canadair, Ltd., at Montreal, Que., producer of military aircraft. He was later produc-

Albert W. Faulconbridge

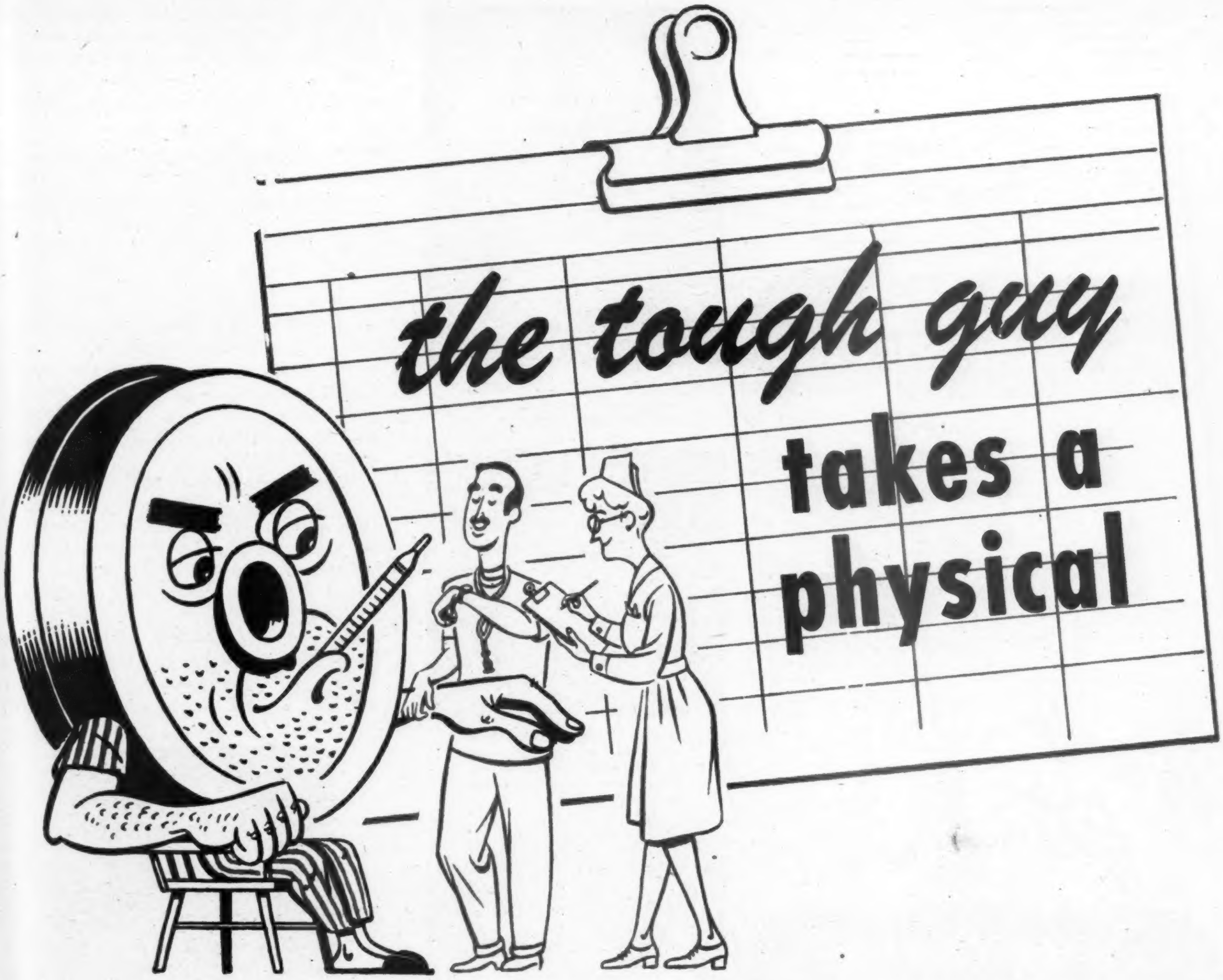
tion manager and manager of the Railroad Division of the Haskelite Manufacturing Corporation, at Grand Rapids, Mich., from which position he resigned to join Ajax-Consolidated.

◆

American Steel Foundries, King Machine Tool Division.—American Steel Foundries has announced the acquisition of the machine tool business of the *King Machine Tool Company,* Cincinnati, Ohio, to be operated as the King Machine Tool division of American Steel. The new division will be operated and managed by *R. D. Brizzolars,* vice-president, and *C. F. Elmes,* vice-president. *Charles F. Muller,* formerly president of the King Machine Tool Company, has joined the new management staff.

◆

American Brake Shoe Company.—*William T. Kelly, Jr.,* has been elected first vice-president of the American Brakeblok division of the American Brake Shoe Company. Mr. Kelly, vice-president of Ameri-



The Tough Guy, as we call the Chilled Car Wheel, isn't a tough guy by accident. We at the AMCCW check up on him to see that he's the kind of performer who lives up to his nickname.

"Taking his temperature" or giving completed wheels a thermal test is only one of a series of steps in a rigid "physical" which has become standard practice with AMCCW members. In this case special equipment demonstrates the ability of the wheel to withstand temperature stresses due to brake application in service.

We're interested in what makes the Tough Guy tough. We're more interested in what makes him tougher. That's why we do more than test wheels and set wheel standards. We test the relative merits of existing and proposed wheel designs.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

445 NORTH SACRAMENTO BOULEVARD, CHICAGO 12, ILL.

American Car & Foundry Co. • Canadian Car & Foundry Co. • Griffin Wheel Co.
Marshall Car Wheel & Foundry Co. • Maryland Car Wheel Co. • New York Car Wheel Co.
Pullman-Standard Car Mfg. Co. • Southern Wheel (American Brake Shoe Co.)

5026

can Brake Shoe since 1946, joined the company in 1928. In addition to his duties as first vice-president of the Brakeblok division, he will continue as president of the Kellogg and Engineered Castings divisions.

◆

United States Steel Corporation of Delaware.—*Richard F. Senter* has been appointed assistant sales vice-president and *M. W. Reed* chief engineer of the United States Steel Corporation of Delaware.

◆

Lima-Hamilton Corporation. — *Lewis A. Larsen*, vice-president and director of the Lima-Hamilton Corporation, has resigned to devote all his time to the Superior Coach Corporation, of which he has been president for five years. His new position will be chairman of the board and chief executive officer.

Mr. Larsen was born in Ridgeway, Iowa, on July 17, 1875. He began his career in 1895 as chief clerk in the office of master mechanic on the Chicago Great Western, at Oelwein, Iowa. In 1896 he was transferred to the motive-power department at St. Paul, Minn., where he worked as chief clerk from 1897 to 1900, when he left to attend Northwestern University. He returned to the motive-power department in 1901 and, in 1902, was appointed chief clerk to the assistant general manager. In 1903 he joined the Northern Pacific at St. Paul, working as chief clerk to the superintendent of motive power until 1907. In that year he was appointed assistant to the vice-president in charge of manufacturing for the American Locomotive Company at New York, and in 1917 he was appointed assistant comptroller. Mr. Larsen joined the Lima Locomotive Works (now the Lima-Hamilton Corporation) in 1917, as secretary and treasurer. In 1920 he was elected vice-president and treasurer, and, in 1944, senior vice-president. He also was a director of Lima-Hamilton since 1918 and has been president and a director of the Superior Coach Corporation for the last five years.

Lewis A. Larsen

◆

Air Reduction Pacific Company.—The Air Reduction Company has formed a new wholly-owned subsidiary to be known as the Air Reduction Pacific Company, which will carry on all the business formerly conducted by the Air Reduction Sales Company in the western region of the United States.

H. P. Etter, formerly sales manager of the Pacific coast division, will be president and a director of the new subsidiary, with headquarters at 220 Bush street, San Francisco 4, Cal., and *W. C. Keeley* will serve as chairman of the board.

◆

SIMMONS FASTENER CORPORATION. — *Harry H. Rose*, formerly sales engineer for the Simmons Fastener Corporation, Albany, N. Y., has been appointed general sales manager.

◆

JOHN A. ROEBLING'S SONS COMPANY.— *E. George Hartmann* has been appointed general sales manager of John A. Roebling's Sons, Trenton, N. J. Mr. Hartmann has been associated with the Roebling Company since 1940. He is a member of the Wire Association and the American Iron and Steel Institute.

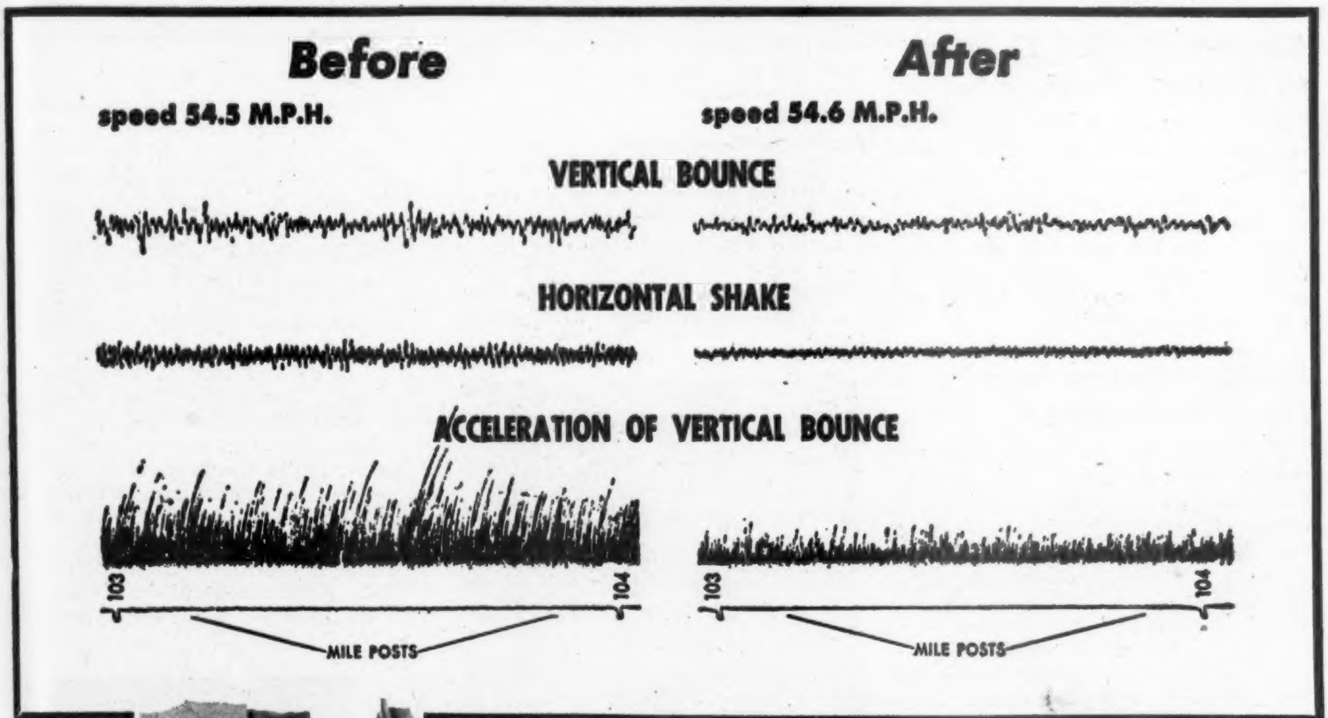
E. G. Hartmann

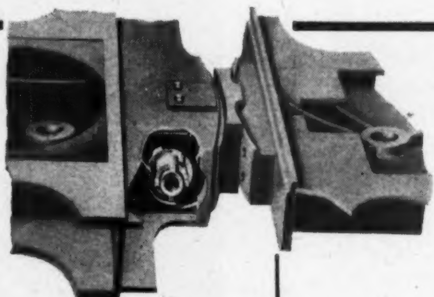
Obituary

FREDERICK P. HUSTON, engineer and metallurgist in the development and research division of the International Nickel Company, at New York, died in Plainfield, N. J., on December 29, 1947. Mr. Huston was 57 years old. He was born at Sweet Springs, Mo., and was a graduate of the University of Missouri in 1912 with a degree of B.S. in electrical engineering. He joined the technical service section of International Nickel in October, 1927. Previous to his appointment as head of the di-

Frederick P. Huston

How to cure a ROUGH-RIDING LOCOMOTIVE





The E-2 radial buffer incorporates a built-in draft gear with large bearing areas. Two large adjusting wedges, energized by compressed springs, hold the chafing plates in firm contact, permitting no slack but retaining complete freedom of movement between engine and tender. This effectively dampens and absorbs both horizontal shake and vertical vibration of the locomotive. Only the Franklin "E" type buffers provide this shock absorbing action.

FRANKLIN E-2 BUFFERS will reduce maintenance by damping and absorbing horizontal shake and vertical vibration.

The E-2 radial buffer will make any locomotive, at any speed, a better riding engine. It requires minimum attention and will cut down maintenance on many related locomotive parts by markedly reducing shake and bounce. Crews appreciate the greater comfort it brings.

The above charts show the effectiveness of this buffer. These charts were made on a western road — two days apart — on the same locomotive, between the same mileposts, pulling the same trainload in the same direction at the same speed. The E-2 buffer, as compared with the wedge-type buffer originally used, reduced vertical bounce 50%, horizontal shake 66%, and acceleration of vertical bounce (impact factor) 62%.

FRANKLIN RAILWAY SUPPLY COMPANY

NEW YORK • CHICAGO • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER • POWER REVERSE GEARS
AUTOMATIC FIRE DOORS • DRIVING BOX LUBRICATORS • STEAM GRATE SHAKERS • FLEXIBLE JOINTS • CAR CONNECTION

vision's railroad developments in February, 1945, he was associated with the INCO mill products division for about five years. Mr. Huston was a member of the American Welding Society, the American Society of Mechanical Engineers, the Master Boiler Makers Association, the American Railway Engineering Association, the New York Railroad Club, the Railway Supply Manufacturers' Association, and the Western Railway Club.

◆

James McHenry Hopkins, chairman of the board of directors of the Camel Sales Company, a subsidiary of the Youngstown Steel Door Company, at Chicago, died on December 20. Mr. Hopkins was born on July 24, 1866, at Xenia, Ohio. He began his career with the Barney & Smith Car Co., in Dayton, Ohio, in 1885, and in 1897 went to Chicago to found the National Railway Specialty Company, now the Camel Sales Company. He became president of the firm in 1908, and subsequently became chairman of its board of directors.

◆

Arnold Stucki, who organized, in 1905, the A. Stucki Company, of which he was president since its incorporation in 1911, died at his home in Bellevue, Pa., on January 11. Mr. Stucki was born in Meringen, Switzerland, on October 30, 1862. After coming to the United States, he was employed by the Pennsylvania from 1889 to 1900. In the latter year he joined the Pressed Steel Car Company as a mechanical engineer. In 1903 he went to the Standard Steel Car Company as chief engineer. Two years later he organized the A. Stucki Company for the manufacture of side bearings.

Arnold Stucki

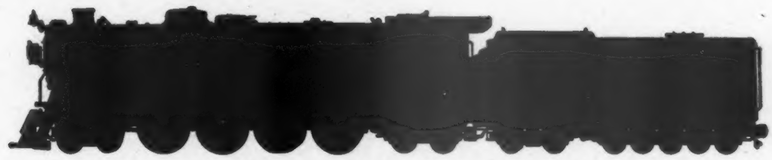
◆

Charles H. White, director of sales of the South and West regions of the Industrial Brownhoist Corporation at Chicago, died suddenly on December 24 at Cleveland, Ohio. Mr. White was secretary and director of exhibits of the National Railway Appliances Association since 1935, and also served as president of that association in 1936.

◆

Robert E. Thomas, eastern sales representative for the brake shoe and castings division of the American Brake Shoe Company, died on December 16, 1947, after a

increases steaming efficiency



The installation of Security Circulators in existing steam locomotives results in a circulation of water from the side water-legs, through the Circulators, over the top of the crown sheet.

Besides this, the Security Circulators, located right in the path of the hot gases, provide a very effective additional heating area for speeding evaporation.

Thus in two ways Security Circulators aid in greatly improving the steaming efficiency of a locomotive.

AMERICAN ARCH COMPANY, INC.

NEW YORK • CHICAGO

SECURITY CIRCULATOR DIVISION

prolonged illness. Mr. Thomas was born in Troy, N. Y., on October 12, 1895. He started his business career with the In-

Robert E. Thomas

ternational Railway Company, Buffalo, N. Y., and after serving as an engineer for the Columbia Machinery Company, he joined American Brake Shoe as a salesman in June, 1926.

◆

HANS B. KRAUT, chairman of the board of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., died recently at his winter home in Tucson, Ariz.

Personal Mention

General

T. F. DONALD, assistant works manager (locomotive) of the Canadian Pacific at Montreal, Que., has been appointed assistant superintendent of motive power, with headquarters at Winnipeg, Man.

W. Q. DAUGHERTY, assistant superintendent of motive power and car equipment of the Gulf, Mobile & Ohio, with headquarters at Jackson, Tenn., has retired after 53 years of railroad service. The position of assistant superintendent of motive power and car equipment at Jackson has been abolished. Mr. Daugherty was born at Verona, Miss., and began his railroad career in the shops of the Louisville & Nashville at Decatur, Ala., in 1892. He became locomotive fireman in 1895. He joined the Mobile & Ohio (now G., M. & O.) in 1895 and subsequently served as locomotive fireman, enginehouse foreman, traveling foreman, and general foreman. Mr. Daugherty was appointed master mechanic at Jackson in 1911 and assistant superintendent of motive power and car equipment in 1942.

H. H. BOYD, assistant chief of motive power and rolling stock of the Canadian Pacific at Montreal, Que., has retired on pension after 47 years of service. Mr. Boyd is a graduate of McGill University. He started his railroad career as a timekeeper on the Canadian Pacific at North Bay, Ont., later serving as district master mechanic at Cranbrook, B. C., and superintendent at Saskatoon, Sask., Moose Jaw and Van-

couver, B. C. Mr. Boyd was appointed assistant chief of motive power and rolling stock at Windsor station, Montreal, in 1928.

E. L. Frazier, Jr., master mechanic of the Pittsburg & Shawmut at Brookville, Pa., has been appointed superintendent of motive power and equipment, with headquarters at Brookville.

L. B. George, assistant superintendent of motive power and car department of the Canadian Pacific in the West at Winnipeg, Man., has been appointed an assistant chief of motive power and rolling stock.

Clarence E. Hatch has been appointed chief mechanical inspector of the New York, New Haven & Hartford, with headquarters at New Haven, Conn.

L. O. Bluerock, draftsman in the employ of the St. Louis Southwestern at Pine Bluff, Ark., has been promoted to the position of assistant mechanical engineer at Pine Bluff.

Walter W. Matzke has been appointed assistant to vice-president—mechanical, of the Chicago & North Western, with headquarters at Chicago. Mr. Matzke was born on December 28, 1907, at Duluth Minn. He received a degree in mechanical engineering from the University of Minnesota in 1929, and in that same year began his railroad career with the Duluth, Missabe & Iron Range. In 1934, he joined the Hartford Steam Boiler Inspection & Insurance Co.,

Walter W. Matzke

as boiler inspector and office engineer at Chicago. He became associated with the C. & N. W. in 1944, and served first as engineer of power plants and machinery and later as mechanical engineer. Mr. Matzke was serving in the latter capacity at the time of his appointment as assistant to vice-president, mechanical.

John L. Roach, whose retirement as superintendent of motive power of the Fort Worth & Denver City (part of the Burlington system), was reported in the January issue, was born at Greencastle, Ind., on November 25, 1874. He entered railroad service in 1899 as an enginehouse laborer on the Missouri Pacific at Kansas City, Kan.; later served as a machinist apprentice; and became a journeyman machinist in 1895. In 1900 he entered the employ of the Atchison, Topeka & Santa Fe, working one year as a machinist, and the following three as shop foreman. After

a year as machine foreman of the Denver & Rio Grande at Pueblo, Colo., Mr. Roach joined the Colorado & Southern (part of the Burlington system), at Denver, Colo., and served as a machinist and assistant enginehouse foreman until March, 1907, when he became shop foreman of the F. W. & D. C., at Childress. A year later he was appointed general foreman; in 1910, master mechanic, and in June, 1947, superintendent of motive power.

M. P. Nunnally, mechanical engineer of the St. Louis Southwestern at Pine Bluff, Ark., has been promoted to the position of assistant superintendent motive power.

S. J. Fuller, assistant mechanical engineer of the St. Louis Southwestern at Pine Bluff, Ark., has been promoted to the position of mechanical engineer.

W. F. A. Benger, chief mechanical engineer of the Canadian Pacific at Montreal, Que., has been appointed an assistant chief of motive power and rolling stock.

C. A. Nicholson, assistant superintendent motive power of the St. Louis Southwestern at Pine Bluff, Ark., has retired.

Frank J. Jumper, general mechanical engineer of the Union Pacific at Omaha, Neb., has retired after 42 years of railroad service.

George S. Robertson, whose promotion to superintendent of motive power of the Fort Worth & Denver City (part of the Burlington Lines), at Childress, Tex., was

George S. Robertson

reported in the January issue, was born in Scotland on April 20, 1887, and began his career as an apprentice ship fitter in yards at Dundee, Scotland. He came to the United States in 1907, and was employed in the building and repairing of ships until 1910, when he joined the F. W. & D. C. as a boilermaker at Childress. He was appointed general boiler foreman in 1918 and general foreman in 1939.

Diesel

Frank E. Stubbs has been appointed general Diesel supervisor, Central Lines, of the Southern, with headquarters at Atlanta, Ga.

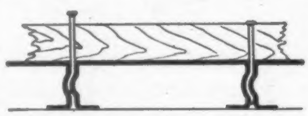
Car Department

Maurice Strawn, wrecker foreman of the St. Louis Southwestern at Tyler, Tex.,

To meet the need for a Stronger Freight Car Floor

NAILABLE STEEL FLOORING

Ribbed NAILABLE STEEL FLOORING channels for boxcar installation before and after application of plastic coating that provides high skid-resistance as well as a level surface.



Smooth-top NAILABLE STEEL FLOORING channels for gondola and flatcar installation with wood blocking secured on top. Ordinary nails are held tighter in the nailing grooves than in wood, yet can be readily removed without damage to the floor. Self-sealing plastic in the grooves prevents loss of fine freight carried in bulk.

Fast and efficient freight handling methods call for fork lift trucks—and their increasing use demands stronger floors in boxcars. Heavily loaded trucks often break right through wood flooring. Additional stringer-supports under wood floors have not stopped this condition. Far too many boxcars must still be assigned to rough freight service or shopped for repairs because of fork truck damage. Unless something is done about it, Class I boxcar supply will be further cut down and maintenance costs will continue to climb.

NAILABLE STEEL FLOORING *does* do something about it. The ribbed channel design provides the strength to support the largest fork trucks used in boxcars. And the high abrasion-resistance of NAILABLE STEEL FLOORING eliminates floor deterioration from forks sliding under loads. Installed in new equipment or as floor replacement in old cars, NAILABLE STEEL FLOORING *stops* the drain on car department funds for floor repairs and provides cars always suitable for all types of freight.

A NEW LOW IN MAINTENANCE COSTS

Elimination of fork truck damage isn't the only way NAILABLE STEEL FLOORING cuts your car repair costs. Look at these other points. The channels are in no way damaged by nailing. They can't be destroyed by hot-box fires. Securely welded to the underframe, they act as a diaphragm that strengthens the entire car. NAILABLE STEEL FLOORING—built to last as long as the car itself—assures a new low in car maintenance costs.

NAILABLE STEEL FLOORING — A GREAT LAKES STEEL PRODUCT

GREAT LAKES STEEL CORPORATION

Steel Floor Division • Penobscot Bldg., Detroit 26, Mich.

UNIT OF NATIONAL STEEL CORPORATION

has been promoted to the position of general car foreman at Tyler.

L. C. KIRKLIN, general car foreman of the St. Louis Southwestern at Tyler, Tex., has retired.

Electrical

J. L. McMULLEN has been appointed assistant general supervisor electrical equipment of the New York Central, with headquarters at New York.

G. S. GLAIBER, assistant general supervisor of electrical equipment of the New York Central, at New York, has been appointed general supervisor of electrical equipment, with headquarters at New York. Mr. Glaiber was born on March 22, 1912, at Savannah, Ga. He received his B.S. in E.E. from the Georgia School of Technology in 1934 and began his career with the New York Central as a special apprentice at the West Albany, N. Y., car shops on August 1, 1935. In 1936 he was given a special assignment as N. Y. C. representative, A. A. R. research. During the summer of that year he was placed on dynamometer car work at the Ohio State University and at the end of the year returned to the West Albany shops for two more years. He then spent six months in the fuel department at Buffalo, N. Y.; was appointed assistant electrical inspector on the Cleveland, Cincinnati, Chicago & St. Louis in May, 1939; electrical inspector in January, 1940, and system electrical inspector in April, 1940. He entered Military Railway Service, U. S. Army, in December, 1942, and served 32 months overseas in North Africa and Italy as a captain. On his return to the New York Central in February, 1946, he was appointed general supervisor car electrical equipment.

G. S. Glaiber

Master Mechanics and Road Foremen

FLOYD E. KIMBALL, assistant master mechanic at Atlanta, Ga., has been appointed master mechanic, with headquarters at Bristol, Va.-Tenn.

H. H. WALKER has been appointed road foreman of engines of the Missouri Pacific, with headquarters at Kansas City, Mo.

J. F. OSHMERA, road foreman of engines of the Laurentian division of the Canadian National, has been appointed division master


MORE POWER less weight...
MORE SERVICE... less wait!

mechanic of the Cochrane division, with headquarters at Cochrane, Ont.

E. L. GROTE has been appointed division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Mason City, Iowa.

G. W. STABLER has been appointed road foreman of engines of the Missouri Pacific, with headquarters at Kansas City, Mo.

ARCHIE G. WALDRUPE, master mechanic of the Southern at Bristol, Va.-Tenn., has been transferred to the position of master mechanic at Macon, Ga.

T. S. LOWE, division master mechanic of the Cochrane division of the Canadian National at Cochrane, Ont., has retired after many years of service.

THOMAS E. GARY, master mechanic of the Southern at Macon, Ga., has retired after more than 40 years of service.

JOSEPH BODENBERGER, general road foreman of engines of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., retired on December 1. Mr. Bodenberger was born in Germany on November 29, 1876. He attended high school and began his apprenticeship as a machinist there, and became a utility mechanic and locomotive fireman in Des Moines, Iowa, in 1896. In 1912 he became traveling fireman; in 1913, locomotive engineman; in 1917, traveling engineer; in 1918, master mechanic at Aberdeen, S. D., and in 1920 assistant master mechanic at Bensenville, Ill. He was appointed general road foreman of engines in 1925.

CARL A. LOVE has been appointed assistant general master mechanic of the Louisville & Nashville, with headquarters at Louisville, Ky.

CHARLES N. WIGGINS, JR., has been appointed general master mechanic of the Louisville & Nashville, with headquarters at Louisville, Ky.

E. L. GROTE, assistant shop superintendent at Milwaukee, has been appointed acting division master mechanic at Mason City, Iowa.

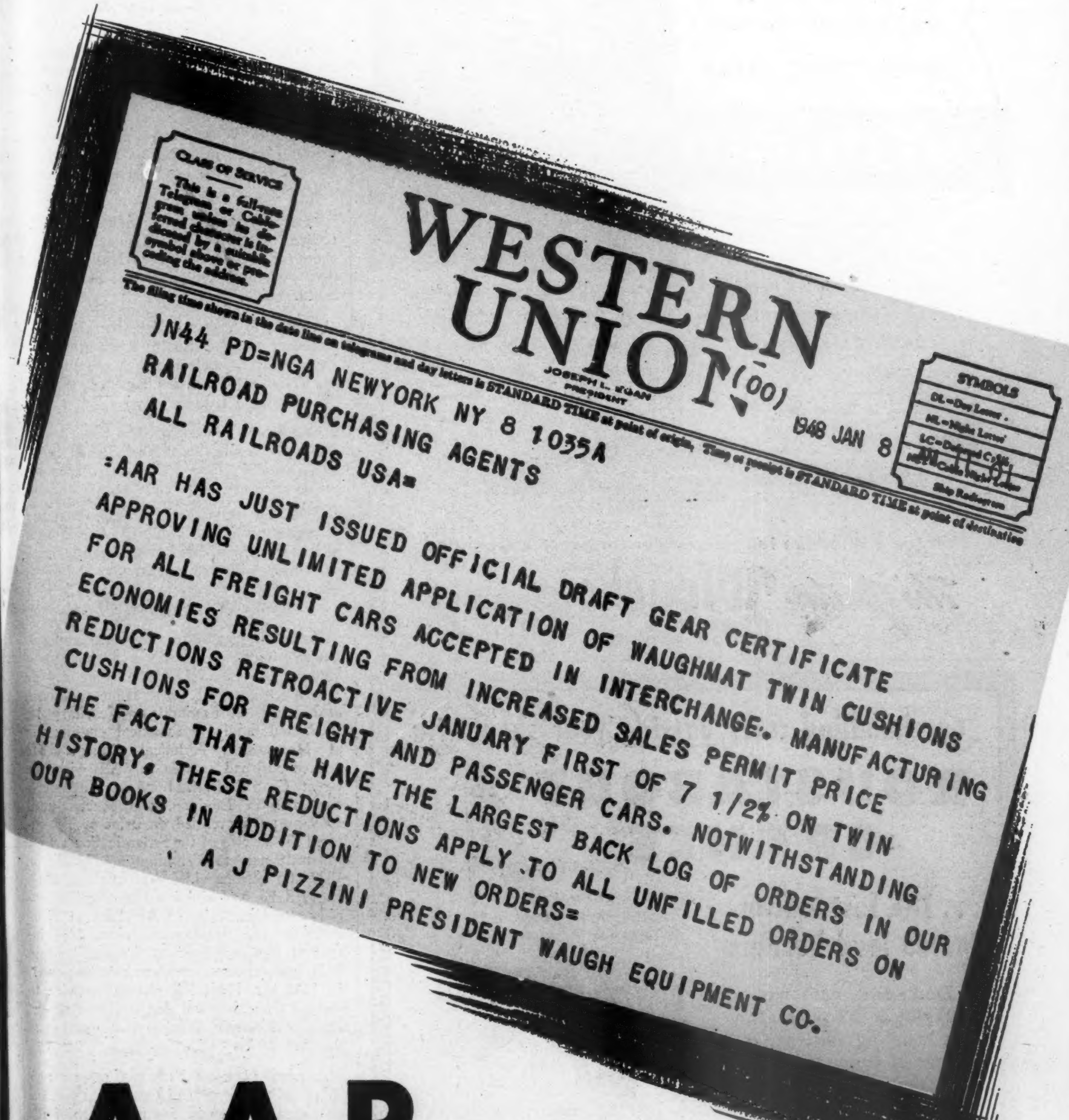
JOHN TURNEY, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Mason City, Iowa, has retired.

Shop and Enginehouse

K. W. THOMSON, assistant foreman at the Stratford, Ont., shops of the Canadian National, has been appointed locomotive foreman, with headquarters at London, Ont.

JOHN F. RYAN has been appointed assistant superintendent of machinery of the Louisville & Nashville, with headquarters at Louisville, Ky.

W. D. DICKIE, supervisor of machinery (munitions) of the Canadian Pacific, has been appointed assistant works manager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WESTERN UNION
JOSEPH L. EGAN
PRESIDENT

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RAILROAD PURCHASING AGENTS
ALL RAILROADS USA=

=AAR HAS JUST ISSUED OFFICIAL DRAFT GEAR CERTIFICATE APPROVING UNLIMITED APPLICATION OF WAUGHMAT TWIN CUSHIONS FOR ALL FREIGHT CARS ACCEPTED IN INTERCHANGE. MANUFACTURING ECONOMIES RESULTING FROM INCREASED SALES PERMIT PRICE REDUCTIONS RETROACTIVE JANUARY FIRST OF 7 1/2% ON TWIN CUSHIONS FOR FREIGHT AND PASSENGER CARS. NOTWITHSTANDING THE FACT THAT WE HAVE THE LARGEST BACK LOG OF ORDERS IN OUR HISTORY, THESE REDUCTIONS APPLY TO ALL UNFILLED ORDERS ON OUR BOOKS IN ADDITION TO NEW ORDERS=

A J PIZZINI PRESIDENT WAUGH EQUIPMENT CO.

A.A.R. CERTIFIED

(locomotive) with headquarters at Montreal, Que.

J. R. Leckie, locomotive foreman of the Canadian National at London, Ont., has retired.

Mark Manley, general boiler inspector of the Louisville & Nashville at Louisville, Ky., has retired following a 51-year career with the road.

Louis E. Wallace has been appointed general boiler inspector of the Louisville & Nashville with headquarters at Louisville, Ky.

William D. Nelson, assistant superintendent of the South Louisville (Ky.) shops of the Louisville & Nashville, has been appointed superintendent of shops at South Louisville.

James W. Adams, assistant to the superintendent of the South Louisville, Ky., shops of the Louisville & Nashville, has been appointed assistant superintendent of the shops.

Ernest O. Rollings, shop superintendent of the Louisville & Nashville at South Louisville, Ky., has retired after 53 years of service.

T. O. Sechrist, assistant superintendent of machinery of the Louisville & Nashville at Louisville, Ky., has retired after 34 years of service with the company.

Obituary

Robert Hunt, former general superintendent motive power of the Seaboard Air Line at Norfolk, Va., died in that city on November 26, 1947. Mr. Hunt was born at Manchester, England, on February 16, 1888, and studied mechanical engineering at Manchester Technical College. He started railroad service in 1901 with the Great Central (now London, Midland & Scottish) in England, and served until 1909 as an apprentice draftsman. He entered the service of the Atlantic Coast Line as draftsman at Wilmington, N. C., in 1909 and became chief draftsman in 1913. In 1918 he was appointed mechanical engineer of the Seaboard Air Line at Norfolk; in 1930, assistant general superintendent motive power at Norfolk and in 1944, general superintendent motive power. In 1943 Mr. Hunt left railroad service to become designing and test engineer of the Berkley Machine Works & Foundry Co. the time of his death.

Arthur Jackson Flowers, master mechanic of the Central of Georgia at Savannah, died on January 3rd after a brief illness. Mr. Flowers would have been 69 years of age on January 16. He was a native of Macon, where he entered the service of the Central of Georgia as a machinist apprentice in August, 1892. He completed his apprenticeship in February, 1896, after which he worked for various railroads at points in Alabama and Georgia. He returned to the shops of the Central of Georgia at Macon in August, 1904. After advancements through various grades, Mr. Flowers was appointed master mechanic at Columbus in November, 1920. He was transferred to Macon in July, 1923, and to Savannah in October, 1935.